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CONTENTS.

EDITORIAL:
- Massachusetts Commission Rules against Providing for Extensions out of Income 265
- The Electrical Exports for 1909 266
- Standardization in Electrical Industries 266
- The National Electric Light Association Convention 266
- Conservation of Water Power 267
- The Propagation of Electrical Waves over Long Distances 267
- Telephones in Mines 267

Street Car Lines to Use Edison Storage Battery 268
Proposed Compulsory Registration of Wireless Stations 268
International Asbestos Association Organizes 268
Electrical Exports for December and for the Year 1909 268
William Marconi 269
Platinum Wire Superior to Nickel for Electric Furnaces 269
The Chemical Behavior of Electrolytes 269
George Westinghouse Speaks at a Joint Engineering Societies Banquet at Boston 270
Fleming's Differential Electric Thermometer 271
Street Railway Dinner 272
Annual Meeting of the Central Electric Railway Association 273
Joint Meeting in Chicago 274
Charles F. Brush Visits His Old Laboratory 275
New York Section, Illuminating Engineering Society 275
Next N. E. L. A. Convention in St. Louis 276
Report of Holyoke, Mass., Gas and Electric Department 276
The Design of Constant-Potential Transformers 277
Lightning-Protection for High-Tension Aerials 279

CENTRAL STATION PRACTICE:
- The Keokuk Power Development on the Mississippi River 280
- Power Developments at Niagara Falls 280

TELEPHONY, TELEGRAPHY AND WIRELESS:
- Wireless Telegraphy 282
- Wireless Telegraphy and Weather Forecasts 285

ILLUMINATING ENGINEERING:
- Street Lighting Fixtures—Incandescent Lamps 286
- A Successful English Experience with Tungsten Lamps 287

INDUSTRIAL POWER:
- Electrically Driven Pumps—V 289
- An Electric Mine Pump 290
- Electric Pumping Estimated to Reduce Expenses at Marquette, Mich. 290

QUESTIONS AND ANSWERS 292
Chicago Electrical Show 293
AMONG THE CONTRACTORS AND SUPPLY MEN 296
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 297

INDUSTRIAL SECTION:
- A Combined Light and Power Meter 298
- New Type of Electric Hammer 298
- Kimble Polyphase Induction Motors 299
- Two Fine Mazda Bulletins 299
- The "Hyray" Automobile Lamp 300
- Automatic Control for Motor-Driven Pumps 300
- A Novel Order Blank for Carbon Brushes 301
- Western Electric Business Good 301
- The Santo Vacuum Cleaner 301
- Large Alternating-Current Motor-Operated Gate Valve 302
- A New Window Reflector 302

CURRENT ELECTRICAL NEWS 303
RECORD OF ELECTRICAL PATENTS 310

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MASSACHUSETTS COMMISSION RULES AGAINST PROVIDING FOR EXTENSIONS OUT OF INCOME.

In a decision made public last week by the Massachusetts Gas and Electric Light Commission the Board issued an important statement of its attitude regarding the practice of providing for extensions and improvements of a relatively costly character out of income, instead of issuing new securities for this purpose. The decision sustained the Beverly Gas and Electric Company's rates for both gas and electricity against an appeal of consumers which has been pending for over a year, but discussed the company's financing of extensions and improvements in the following language:

"Of the gross expenditure of the company, under its present management, for new construction, more than one-third, or upwards of $180,000, has been obtained from earnings, and a large part of this in the more recent years. These figures indicate that, notwithstanding the numerous and fairly frequent reduction in price made by the company, the profits, in excess of dividends, which have been used to extend and improve its plant have been larger than can readily be justified in view of the duty which the company owes the public. In the early days of public service corporations such a policy was very general and justified by the belief that, as the capital charge was kept low and the amount per unit required for dividends decreased, low prices might be more certainly and quickly attained. If, however, the claim now made by some companies is to be conceded, and the same return is to be allowed upon the value of all property employed for the public convenience from whatever source derived, no benefit accrues to the public from such accumulation. If the claim can be successfully made, it amounts in effect, if not in form, to a stock dividend. Nor is such a claim necessary to insure a continuance of the commercial prosperity of companies of this class.

"The public has a substantial interest in what remains of the net earnings above a fair dividend. No corporate interest properly viewed requires that such a surplus be distributed to the stockholders or so invested as to impose new burdens upon consumers. A public service corporation exercising a virtual monopoly is bound to give its customers the best possible service at the lowest reasonable price, nor is the discharge of this duty to be measured merely by a comparison with the service and price prevailing elsewhere. After a payment of reasonable operating expenses, proper allowance

for depreciation and emergencies, and a fair return upon the investment, surplus earnings should be used to facilitate further reductions in price. The Board is convinced that this company no longer needs to continue, as heretofore, to provide capital for extensions out of income. As soon as the combined effect of the recent reductions (which were voluntary—Eds.) and the necessary prospective expenditure and changes shall be realized, if profits shall then exceed dividends, as in some former years, it will be the plain duty of the management to make a further revision of existing rates."

This enunciation of the Commission's position is one of the most important which has appeared in its supervision of public utilities in recent years.

THE ELECTRICAL EXPORTS FOR 1909.

On another page of this issue there appears the usual monthly summary of the electrical exports from this country, as prepared from the latest report of the government statistical bureau. The figures thereby made public for the month in question (December) have enabled a complete tabulation of the electrical exports for the calendar year 1909 to be made by months and by classification into appliances and machinery. Although the appliances include electrical instruments and telegraph and telephone equipment, the latter is the largest item in this class. The monthly and annual figures disclose some very interesting facts.

The grand total of electrical exports for 1909 is $13,027,550, as compared with $12,613,730 for 1908, and $17,460,775 for the banner year 1907. This shows some revival of the export business from the severe depression of 1908, but a further analysis of the annual totals shows a marked change in the character of the exports. The exports of electrical appliances for the last three years were $7,063,804 in 1909, $5,657,008 in 1908, and $7,725,545 in 1907; exports of electrical machinery were $5,963,746 in 1909, $6,956,722 in 1908, and $9,735,230 in 1907. Thus the machinery exports have steadily diminished from their leading position in 1907 to their present secondary position, whereas the exports of appliances have nearly recovered to the value in 1907 and now form the leading class of electrical exports.

The foreign demand for electrical machinery has suffered from the world-wide depression in all industrial lines which has hampered the development of new projects everywhere. Incidentally also competition has become keener. In the telephone industry, however, this country has not only been steadily far in the lead, but other countries, gradually awakening to the advantages of telephone service and realizing their backwardness in this regard, have been compelled, in spite of depression, to purchase American telephone equipment in order to get the most efficient and up-to-date apparatus available in this line. This accounts for the predominance of the electrical appliance exports. Had the machinery exports remained in their old relative position, the total electrical exports would now be again well toward the high mark established in 1907. The second half of 1909, as compared with its first half, does not hold out much encouragement as regards the immediate revival of the machinery exports to their formar level. Nevertheless the revival of the appliance exports is most gratifying and gives hope for further advance.

STANDARDIZATION IN ELECTRICAL INDUSTRIES.

The speech of Mr. George Westinghouse, delivered recently at an engineering men's dinner in Boston and given at considerable length in another part of this issue, brings to the front a topic which should prove of the greatest interest to the electrical industry in this country, namely, that of standardization.

Mr. Westinghouse showed clearly the enormous losses which prevail in electrical manufacturing in this country by the many diverse standards which are adopted by the various makers of motors and other devices to suit special trade requirements, most of which could be obviated by the adoption of a uniform standardization. The unregulated competition among manufacturers, he said, has made the electrical trade one of the poorest in the country in the matter of profits. He recommended a combined effort of all of the engineering societies, acting with the support and approval of the manufacturers, toward the establishment of a bureau of standardization to deal with this question.

Another thing pointed out by Mr. Westinghouse was the need for uniformity and standardization in the matter of railroad main-line electrification in this country. In this connection the dearly bought experience of the steam railroads in the adoption of a uniform track gauge was mentioned as a warning, and Mr. Westinghouse advised that in the near future a system should be selected which would be capable of universal use, so that an electric locomotive or car of any one line could operate on any other road in the country.

Much good work on standardization has already been effected by the American Institute of Electrical Engineers, the American Society of Electric Motor Manufacturers, the American Street and Interurban Railway Association, and other engineering bodies in this country, but a concerted effort by all of the engineering societies and by the manufacturers, such as recommended by Mr. Westinghouse, would seem to be what is really needed.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTION.

The executive committee of the National Electric Light Association has selected St. Louis, Mo., as the place where the next convention will be held. The date will be May 23-28. St. Louis is one of the easiest cities in the country to reach and is well located for a convention at that time of the year. Its people are generous and hospitable and it is a thriving city electrically. Already the electrical interests of St. Louis are busy with their plans, and, with the great growth that has come to the Association during the past year, this should be one of the best attended and most important conventions yet held.

CONSERVATION OF WATER POWER.

The only way to conserve water power is to use it.

Since the beginning of time, water representing millions of horsepower has annually gone down stream, and only the small amount developed has been conserved.

Secretary of Interior Ballinger has recently reported to the President that grants for the development of water power on public lands should be limited in time to thirty years or more, that the Government make a charge based on the cost of development or the gross earnings and adjusted every ten years, and that all rights be forfeited upon entry into any agreement to fix rates beyond a reasonable profit on the investment.

What must be the effect of such conditions on the development and use of water power?

Hydraulic structures such as dams and canals often have a life of centuries, and the large investments necessary for such work will hardly be made unless a return is to be expected for many times thirty years.

After the development of water power has been made, every government charge or tax on the installation, whether referred to its first cost or gross earnings, must fall in the first instance on the users of power, and may or may not be shifted to the users of goods manufactured with the power, according to circumstances. A tax or charge on power is thus a tax on industry or consumption, and raises the question why out as the objects of special taxation. Evidently money out as the objects of special taxation? Evidently money will not be invested in the waterpower projects unless the net earnings above all taxes and charges offer an attractive return.

The drastic provision that any agreement or combination to charge more than reasonable rates shall work a forfeiture of all rights in the waterpower development is obviously enough in itself to deter investors in such a project. If rates of a public service corporation are found by investigation to be unreasonable, it is a proper function of government to prescribe reasonable rates, but it was certainly never decided that the corporation should be deprived of all its property in such a case.

As far as government regulations affecting the income of companies that develop public water powers are concerned, it appears that the interests of consumers will be protected by suitable provisions for reasonable rates.

In this connection it may be noted that a very large part of the undeveloped water power of the United States is not now within the jurisdiction of the Federal Government to grant or to withold, but is primarily under the control of the several states.

Congress, however, has an indirect control over most of the water powers in every state, because of its paramount power over navigation in the interest of interstate and foreign commerce. Thus for the protection and promotion of navigation the Federal Government not only has power to pass on the character of structures that may be erected in rivers, but also to regulate the extent to which water may be diverted.

THE PROPAGATION OF ELECTRIC WAVES OVER LONG DISTANCES.

William Marconi's Nobel Prize lecture, of which an extended abstract appears in another part of this issue, is one of the best short treatises that have yet appeared on the subject of wireless telegraphy. One of the points taken up in this lecture, that of the propagation of electric waves over long distances, is worthy of more than passing interest, for herein lies one of the most perplexing problems of the art of wave telegraphy, and one that has important bearings on its successful commercial exploitation.

Mr. Marconi suggests that the absorption of electric waves during the daytime is due to the ionization of the air molecules by the ultra-violet rays of the light emitted by the sun, inasmuch as this ionized air, according to Sir J. J. Thomson, will absorb some of the energy of the electric waves. He further suggests that the wave length and the amplitude of the electrical oscillations have something to do with the phenomenon,—waves of great length and small amplitude, he says, being less affected by absorption than those of short length and large amplitude. Mr. Marconi makes this last statement from the result of his own observations, although he quotes Professor Fleming as being of the contrary opinion.

The subject is an exceedingly fascinating one from a purely physical standpoint, and there is no doubt but that the physicists will take up the problem in a systematic way now that Mr. Marconi has put the question fairly and squarely up to them. And besides the pleasure and satisfaction to be obtained from a correct solution, there should be the added incentive of material reward, for practical discoveries and workable methods for overcoming the uncertainties of distant signaling along the lines suggested will do almost as much to aid in establishing commercially the art of wireless communication as did Mr. Marconi himself when he made his great discovery of the elevated aerial.

TELEPHONES IN MINES.

The many advantages of the telephone in everyday life are apparent to all, and it is therefore a matter of wonder that this useful—one might say indispensable—adjunct to civilization is not more universally in use in mines than is at present the case. The distribution of supplies, the calling for and giving of instructions at the various stations, and last, but not least, the material aid afforded by a quick knowledge of accidents in the workings, are matters which seem to indicate that a complete and efficient telephone service should be installed in every mine in the country. That such will eventually be the case is not to be doubted, but delays will cost money and lives, and it therefore behooves mine managers and legislative bodies to see that any omission of this kind be speedily remedied.

Pacific Coast Electrical Exposition.

It is announced that work on the rebuilding of the new Coliseum at San Francisco, Cal., is well under way and contracts call for its completion during the month of March.

It has been decided to hold the Electrical Exposition about April 1, the date for the opening to be announced when the work on the building is further advanced.

The executive committee of the Pacific Coast Electrical Exposition is as follows: Chairman, E. M. Scribner; vice-chairman, W. W. Briggs; John R. Cole, W. L. Goodwin, R. B. Elder; Albert H. Elliot, secretary-treasurer; D. M. Moses, general manager.

Street Car Lines to Use Edison Storage Battery.

Preliminary steps have been taken at Caldwell, N. J., for the formation of a street car company, which will use the storage battery invented and recently perfected by Thomas A. Edison. John Ottenheimer, who is interested in the proposed company, says the plans are that the new concern will act as a feeder for the Public Service Railway Company or the Erie Railroad. It is proposed to start with about twenty cars. These will be housed in a central station at Caldwell, and will cover the town and the country thereabouts which is not reached by the trolley line or the steam railway.

The first tests of the Edison storage battery for street car service were made at West Orange, N. J., on January 20, and were described in these columns in the last issue.

Proposed Compulsory Registration of Wireless Stations.

A recent dispatch from Washington, D. C., states that regulations designed to prevent interference of mere triflers with official and commercial wireless telegraph and telephone business and bona fide experimental work are provided in a substitute joint resolution introduced by Representative Burke of Pennsylvania.

Mr. Burke says he believes the measure would not interfere with progress.

"A requirement that all wireless stations within Unitd States jurisdiction, ashore and shipboard, shall register with some Government Department which shall preserve a record of such stations," according to Mr. Burke, "will enable the Government to control the business sufficiently to prevent interference by irresponsible people in whose hands a wireless station like a firearm might menace public safety. The setting apart of certain wave lengths for exclusive Government business and certain other purposes would provide all needed protection."

International Asbestos Association Organizes.

The International Asbestos Association was recently organized at a meeting held in New York. Its membership is composed of representatives of American and Canadian mine owners and manufacturers. The interests at the meeting represented between eighty and ninety per cent of the asbestos business in the United States and Canada. Included in the association are the largest producers and users of asbestos in the United States and Canada, among them the Amalgamated Asbestos Corporation, Limited, Keasbey & Mattison Company, Philip Carey Manufacturing Company, Asbestos Protected Metal Company, Franklin Manufacturing Company, H. W. Johns-Manville Company, Sall Mountain Asbestos Manufacturing Company, Ling Asbestos Company, and the United States Asbestos Company. The aggregate capitalization of the concerns who are so far represented is over $40,000,000. The following were elected officers of the association: T. F. Manville, president; R. V. Mattison, Jr., vice-president; R. P. Doucet, secretary.

It is announced that the purposes of the association are the general exploitation of the uses of asbestos, particularly in the field of fireproof construction, co-operation between consumer and producer, cultivation of new markets, and development of processes whereby the wastes in the industry may be made commercially valuable.

One of the important factors in the association is the so-called Canadian "Asbestos Trust"—the Amalgamated Asbestos Corporation, Limited—a combination of several of the most important Quebec asbestos properties located at Black Lake and Thetford, and which controls eighty per cent of the output of these districts. The greater part of the world's supply of asbestos comes from the Black Lake and Thetford districts.

Asbestos is produced in Canada, Russia, the United States, Cape Colony, and the island of Cyprus. It is stated that the Canadian asbestos supply is practically inexhaustible and that it is the chief factor in the control of the asbestos industry of the United States, and, in a marked degree, of the world.

Electrical Exports for December and for the Year 1909.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has completed its official monthly summary of imports and exports of the United States for December, 1909, and therefore also its annual summary for the calendar year 1909. From these statistics the following facts and figures relative to the electrical exports are taken.

Electrical exports are subdivided into electrical appliances and electrical machinery. Electrical appliances are classified under instruments and apparatus for scientific purposes and include telegraph and telephone instruments. Electrical machinery is classed under iron and steel, and manufacturers thereof. The ups and downs in values of electrical exports by months during the past year and during the preceding December are clearly shown by the following table:

Month.	Electrical Appliances.	Electrical Machinery.	Total Electrical Exports.
Dec., 1908	$611,611	$587,559	$1,199,170
Jan., 1909	500,309	452,851	953,160
Feb., 1909	462,856	598,736	1,061,592
Mar., 1909	681,083	579,499	1,260,582
April, 1909	490,483	489,026	979,509
May, 1909	539,424	479,951	1,019,375
June, 1909	595,044	667,453	1,262,497
July, 1909	567,795	391,195	958,990
Aug., 1909	590,864	448,976	1,039,840
Sept., 1909	686,049	480,835	1,166,884
Oct., 1909	683,819	443,388	1,127,207
Nov., 1909	584,210	470,687	1,054,897
Dec., 1909	681,868	461,149	1,143,017

For the last three calendar years the total values of the electrical exports were:

Year.	Electrical Appliances.	Electrical Machinery.	Total Electrical Exports.
1907	$7,725,545	$9,735,230	$17,460,775
1908	5,657,008	6,956,722	12,613,730
1909	7,063,804	5,963,746	13,027,550

Referring back to the detailed figures for the month of December, 1909, a list of the principal countries to which electrical products were sent and the values of these exports is given below:

Exported to—	Electrical Appliances.	Electrical Machinery.
United Kingdom	$67,862	$35,929
Belgium	10,571	.....
France	4,198	64,472
Germany	9,782	5,595
Other European countries	4,921	9,377
British North America	181,406	52,283
Central American states and British Honduras	26,902	51,922
Mexico	78,890	38,212
Cuba	54,320	7,770
Other West Indies and Bermuda	7,744	6,150
Argentina	30,696	44,117
Brazil	89,886	29,186
Other South American countries	31,589	15,867
British East Indies	.....	5,275
Japan	25,098	16,577
British Australasia	8,125	47,455
Philippine Islands	40,812	4,746
British Africa	3,558	19,181

William Marconi.

William Marconi, whose Nobel prize address is given on other pages of this issue, it is understood, will shortly arrive in America to supervise a new installation of his transatlantic wireless apparatus at Glace Bay, Nova Scotia, in place of that destroyed last year by fire. The station of Clifden, on the Irish coast, has been re-equipped and Marconi is confidently looking forward to a resumption of transatlantic wireless service within a very short time. Experience in the actual working of this system before the destruction of the Glace Bay station had given opportunity for valuable observation, which will be utilized in the re-equipment of both the Irish and Newfoundland stations.

Marconi was born on April 25, 1874, near Bologna, Italy, and early in life achieved renown as an inventor. He has always been an ardent student of physics and made a particular study of the facts of oscillatory motion and Hertzian phenomena.

Regular transatlantic communication by means of wireless telegraphy between Marconi stations at Clifden, Ireland, and Glace Bay, Nova Scotia, was begun on October 17, 1907.

Marconi received the Nobel prize for physics for his researches and developments of wireless telegraphy, the prize amounting to $20,000. The privilege of awarding the prize is maintained by the Swedish Academy of Science. This year the prize was divided between Prof. F. K. Braun of Strasburg University, Germany, and Mr. Marconi, the whole prize amounting to $40,000.

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WILLIAM MARCONI,
Winner of the Nobel Prize in Physics for Researches in Wireless Telegraphy

Block Signal Systems on Steam Lines.

The Attorney General of Indiana has ruled that while the railroads may be required, under the law, to install block signal systems, the system installed need not be of a type approved by the State Railroad Commission. Any system approved by railroads, whether manual controlled, automatic or electric, will be sufficient to comply with the law.

Platinum Wire Superior to Nickel for Electric Furnaces.

The use of nickel wire for electric furnaces is not preferred to platinum, says *Engineering*, of London, Eng., because, although much cheaper, the nickel becomes brittle when exposed to high temperature. Professor H. C. H. Carpenter found this brittleness to be partly due to the gradual escape of the occluded gases. Professor M. Le Blanc, of Leipzig, on the other hand, found nickel wire suitable in experiments in which the furnaces were heated to a temperature of about 1,300 degrees centigrade, and Prof. Walter Nernst mentioned during the discussion of a paper read by M. Le Blanc in the Deutsche Bunsen Gesellschaft, that he wound his nickel wire on a copper tube (instead of clay or porcelain) and insulated the copper with asbestos and sodium silicate; the wire itself was finally coated with a mixture of sodium silicate and soapstone. These copper-tube furnaces cannot be heated above a temperature of 1,000 degrees centigrade.

The Chemical Behavior of Electrolytes.

The address of the vice-president and chairman of Section C—Chemistry—of the American Association for the Advancement of Science, at Boston, last year, contained some interesting remarks on the chemical behavior of electrolytes, as follows:

In some quarters the idea is still prevalent that electrolytes are essentially different from non-electrolytes in their chemical behavior. This is thoroughly fallacious, for all chemical changes that occur in electrolytes can now be reproduced as to type and as to rapidity in the best of insulators. An electrolytic solution behaves like any other solution, except that it has the property of conducting electricity with concomitant chemical decomposition.

There is no way known at present by which any one can foretell whether a given solution will conduct the current or not. The only way to find out is by actual trial with the electric current itself. There is also a misapprehension that only electrolytes will cause the coagulation of colloids. Such coagulation can be quite as well accomplished by non-electrolytes, so that here too there is no essential difference between electrolytes and non-electrolytes.

Upon what electrolytic conduction really depends we are still quite ignorant, just as we do not know why a bar of silver conducts and a stick of sulphur insulates.

Canada Seeks to Control Rates of Ocean Cable Companies.

It is reported that Rudolphe Lemieux, Postmaster General of Canada, has introduced a bill in the Canadian House of Commons to control the rates and facilities of ocean cable companies. This bill, if passed, would put the cable companies under the jurisdiction of the Board of Railway Commissioners.

This is the first move by the Canadian Government as the result of negotiations which have been in progress between the British Postmaster General and Mr. Lemieux, the object being a cheaper service across the Atlantic.

George Westinghouse Speaks at a Joint Engineering Societies' Banquet at Boston.

Three engineering societies, the Boston Society of Civil Engineers and the Boston sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers, gave a joint dinner on Friday evening, January 21 last, at the Hotel Somerset, Boston, Mass., to promote a kindredness of spirit among engineers in Boston and district, and to introduce to the 500 or so assembled members and guests the following prominent engineers,—George Westinghouse, president of the American Society of Mechanical Engineers; John A. Bensel, president of the American Society of Civil Engineers, Lewis B. Stillwell, president of the American Institute of Electrical Engineers, and George B. Francis, president of the Boston Society of Civil Engineers. One of the results of the meeting which followed the banquet was the appointment of a joint committee to consider plans for the formation in Boston of a central engineers' clubhouse similar to the Engineering Societies' Building in New York city.

Before the banquet, the four presidents mentioned above received the members and guests in the parlors of the hotel. After the banquet, which was held in the ballroom, Prof. Ira N. Hollis, of Harvard University, presided at the meeting which followed, and before introducing Charles B. Edwards, of the Fore River Shipbuilding Company, Quincy, Mass., mentioned the interesting fact that besides the presidents of the three great national engineering societies there were present at the meeting the presidents of sixteen other engineering and scientific societies or institutions.

Mr. Edwards gave an illustrated lecture on "The Main and Auxiliary Machinery of the United States Battleship North Dakota." The electric generating equipment of this ship includes four 300-kilowatt turbo-generators, occupying a floor space of forty-two by twenty feet. The repair-shop machine tools are individually driven by electric motors. An interesting fact adduced by Mr. Edwards toward the close of his talk was the great increase in power for an increase in speed. The figures for the particular ship under discussion were as follows: 12.0 to 12.5 knots, increase of 46.0 horsepower; 19.0 to 19.5 knots, increase of 1,620 horsepower; 21.0 to 21.5 knots, increase of 4,400 horsepower.

President Francis, of the Boston Society of Civil Engineers, started the ball rolling which culminated in the appointment of the clubhouse committee as mentioned above. He said that 5,000 men would directly be interested in an engineer's club for Boston and vicinity. President John A. Bensel, of the American Society of Civil Engineers, heartily indorsed the former speaker's remarks.

Lewis B. Stillwell, president of the American Institute of Electrical Engineers, spoke on co-operation as a basis of true progress, and in a congratulatory vein he paid tribute to the other two national societies on the choice this year of their presidents. Especially did he laud Mr. Westinghouse, not only for his personal attainments but for his influence on those who had been associated with him in his great works.

R. Clipston Sturgis, president of the Boston Society of Architects, spoke of the better feeling which now prevails between engineers and architects, and Charles Francis Adams, former chairman of the Massachusetts Railroad Commission, reminisced entertainingly about his early associations with Mr. Westinghouse.

The speaker of the evening was George Westinghouse, president of the American Society of Mechanical Engineers, who followed with an address on "Monopoly Competition and Standardization." Mr. Westinghouse was received with acclamation on arising to deliver his speech, an abstract of which is given below:

For many years, and particularly in recent ones, the tendencies have been and are now strongly toward large and powerful railway and industrial combinations and their constant skillful development, the very magnitude of which, with the evil practices so frequently disclosed in the press and in our law-courts, have so aroused the public that there is now a fixed determination to establish by national and State laws an exacting governmental control of practically all forms of corporations in order that competition may be encouraged and not stifled, but seemingly without due regard to the real objects in view, viz., the securing of the best public services in all forms; the best foods and goods for our daily needs; the greatest possible comfort to the masses; and as great freedom as possible from those restrictions which hinder rather than promote honest endeavors.

Many of the hardships which will arise in the daily conduct of our affairs as the result of existing and proposed legislation might have been avoided by those responsible for the creation of great combinations had they appreciated the inevitable consequences of their selfish and unwise course in their efforts to gain a monopoly by suppressing competition by methods so transparently wrong that those efforts have been met by the strongest possible demand for controlling legislation.

I have said the tendencies have of late years been towards large combinations, but fortunately there are indications, of which this gathering is one of many, that the great leaders in our affairs (as witness the meetings now being held in Washington of Governors of numerous States) are alive to the importance of the regulation of legislation and the creation of sentiments which will bring business men to their senses.

The engineering societies, by like joint action, have it in their power to do much to better conditions. Probably there is no better way for them to do so than to show, from their knowledge and experience, that unregulated competition and rivalry in business have established conditons which have made our costs greater and rendered ideal conditions in industrial engineering matters most difficult of realization.

To make this clear, I need only call your attention to the effects of this unregulated competition in one great industry—the electrical—which has grown up in less than twenty-five years. No user of electrical apparatus can fail to appreciate the advantage it would be to him when some repair part is needed if certain standards were followed by all constructors with reference to equivalent devices; but it is lamentable to say that with the single exception of uniform bases for incandescent lamps, there are now practically no standards.

To illustrate further the points I have tried to bring to your attention, I quote as follows from a letter to me on this subject:

"To illustrate the growth in the number of motor ratings required now as compared to the earlier days when sixty ratings sufficed, a summary is given of the motors manufactured by the company with which I am connected. These figures refer to stationary motors only in sizes up to 200 H. P. All of these motors are regularly manufactured and no special motors are included.

For direct current, fifty-five frames are used giving 1600 ratings.
For alternating current, eighty frames are used giving 1950 ratings.
Or a total of 135 frames are used giving 3550 ratings.

"Practically any one of these may be furnished in three types, (a) shaft horizontal, (b) shaft vertical, (c) with countershaft bracket and bearings mounted on the frame.

This makes a total of three times 3550 or something over 10,000 different motors available. In spite of this, there is a constant and increasing demand for special motors. In the past year approximately 10,000 estimates have been made on special motors under 200 horsepower, even though the greatest effort has been made to divert all inquiries to our regular lines of motors.

"Many of these special estimates were necessary because the prospective customer wanted to buy a motor having the same characteristics as a motor offered by some other manufacturer. Our standard motor may have differed in any one of the following characteristics: (a) Horsepower or speed rating. (b) Dimensions of base. (c) Overall dimensions. (d) Height from base to center of shaft. (e) Weight. (f) Method of lubrication. (g) Size of shaft. (h) Performance guarantees.

"This demand for special apparatus places a heavy burden on the manufacturer. The purchaser also suffers because of increased cost and long deliveries.

"Consideration of the above and a general review of the situation leads to the conclusion that the benefits that will result from standardization will more than com-

pensate for the work and expense required in making the necessary changes."

While these quoted particulars relate to only a part of the motors made by one large company, it must not be forgotten that there are half-a-hundred others manufacturing equivalent lines of motors and that each maker has his own patterns and designs, so it is safe to say there are fifty or more thousands of needless variations in motors which have added many millions of dollars to the investment already made in installations of electrical machinery.

I have long believed, and have urged upon my associates for the fourteen years during which the two large electric companies have had the joint use by a license agreement of several thousands of patents relating to their business, that by co-operation in the development of apparatus and by the use of the same designs and by the exchange of engineering and manufacturing particulars, there would be evolved the very best of all kinds of electrical machinery and details, and that the products of the two companies could be made interchangeable, not only to the advantage of purchasers and users of electrical apparatus, but also to the advantage of the companies themselves. Other views have prevailed, however, and there has existed an unregulated competition which has made the electrical industry about the poorest of all in the matter of profits.

There are many here who know of the consequences of the adoption of different gauges for railways, the final result being a change, at enormous expense to those railways having had the disadvantage of adopting a standard which differed from that of their more powerful neighbors. Unless there be some action in the near future those who have the gift of foresight, we will soon have a like difficult condition to meet due to the establishing of widely different systems for the electrification of our main railways. It seems certain that in the near future a system should be selected which would be capable of universtl use, so that an electric locomotive or car of one railway could operate upon all other lines.

Obviously, the selection of such a system should be removed largely from the domain of commercial competition.

Those engineers who have studied the problem of the electrification of our railways, cannot have failed to realize that it is not only a question of the development and selection of the right system, but that the financial questions involved are such that the speedy realization of the complete electrification of the railways, either of the entire country or of even populous sections, cannot be forthwith carried out; in other words, there must be given full consideration to those who have the management of our railways in the difficult problems before them, not the least among which being the raising of the capital required to carry out what will be really stupendous operations.

By a combined effort of all of the engineering societies with the financial support of all manufacturers who would be largely benefited and who could well afford to pay in pro-rata amounts the expense of a well-equipped bureau of standardization, it seems to me such a bureau could be established and could work a reform of incalculable value in our present practice and thus forestall governmental activity in the same direction.

Apparatus for Thermo-Penetration.

Thermo-penetration is the name given to the heating of interior parts of the body by means of high frequency currents. The first observation of a heating effect was made by Zeyneck during his investigations on the conductivity of the animal organism. The heating effect observed was very slight, however, and the method had no therapeutic value. Zeyneck generated the high-frequency currents by means of the electric spark and this explains the low heating effect, for electrical vibrations thus produced are greatly damped, that is, interrupted by electrically useless pauses that are several hundred times longer than the effective phenomenon. It is therefore evident and has been demonstrated by experiment, that the most favorable results will be reached by undamped electrical vibrations. The C. Lorenz Company has put an apparatus on the market which operates with undamped waves produced by the Poulsen method and meets the clinical and experimental requirements in every way. A few seconds after the part of the body to be treated is placed between the electrodes conveying the high-frequency current, an agreeable sensation of warmth is felt therein. The patient has no other feeling than that of warmth, and at the same time pain disappears almost completely. The relief from pain lasts for several hours after the treatment.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), December 12.*

Fleming's "Differential Electric Thermometer."

In a paper recently presented before the Institution of Electrical Engineers, London, England, Prof. J. A. Fleming described a remarkable instrument which he called a "differential electric thermometer."

This, says *Electrical Engineering* (London, England) comprises two long glass tubes of large section, closed at top and bottom with mercury airtight stoppers, and connected by a fine-bore tube containing a colored water thread with an air bubble in the center. Pieces of wire or strip, the resistance of which is to be measured, are placed in the tubes, and connected through the stoppers, one with a source of high-frequency current, and the other with a source of direct current. The currents are adjusted until equal heat is generated in each tube, this condition being indicated by the bubble in the water thread remaining in the middle of the connecting tube. The ratio of the resistance values will then be inversely as the square of the currents.

To measure the current, a special form of hot-wire thermo-electric ammeter was employed. This comprised a number of bare No. 36 standard wire gauge copper wires, soldered to end pieces of brass, with an iron-nickel thermo-electric junction attached to the center of the middle wire, and connected to a galvanometer. For such small wires well spaced out, the ratio of the resistances to high-frequency and continuous currents is unity, and it will read the root-mean-square value of an oscillatory current correctly after having been calibrated by direct current.

The values obtained with this apparatus compared on the whole very well with calculated values. Thus No. 16 standard wire gauge gave, with a frequency of 450,000, a high-frequency resistance 4.57 times the normal resistance, while the calculated value was 4.54 by the Russell formula. For bare copper cable (7/22) such as is used for antennas, the ratio for a frequency of 439,000 was 4.2, and 6.1 for a frequency of 735,000. It was also found with this apparatus that the ratio of the resistance of a spiral of No. 16 standard wire gauge to that of the same wire stretched out, was 1.25 for a frequency of 450,000.

Instantaneous X-Ray Photography.

In a recent issue of the *Physikalische Zeitschrift*, Friedrich Dessauer describes a powerful apparatus he has devised for shortening the time of exposure in X-ray photography. The induction coil used is of great size and is supplied with a powerful current which on arising to a predetermined value is quickly broken by a fuse consisting of a calibrated piece of wire embedded in a mixture of earths. When the wire heats, water vapor is quickly formed under pressure, whereupon the fuse violently explodes and breaks the current. By means of this device Herr Dessauer has been able to obtain X-ray cinematographs of the beating of the human heart.

Annual Stevens Alumni Dinner.

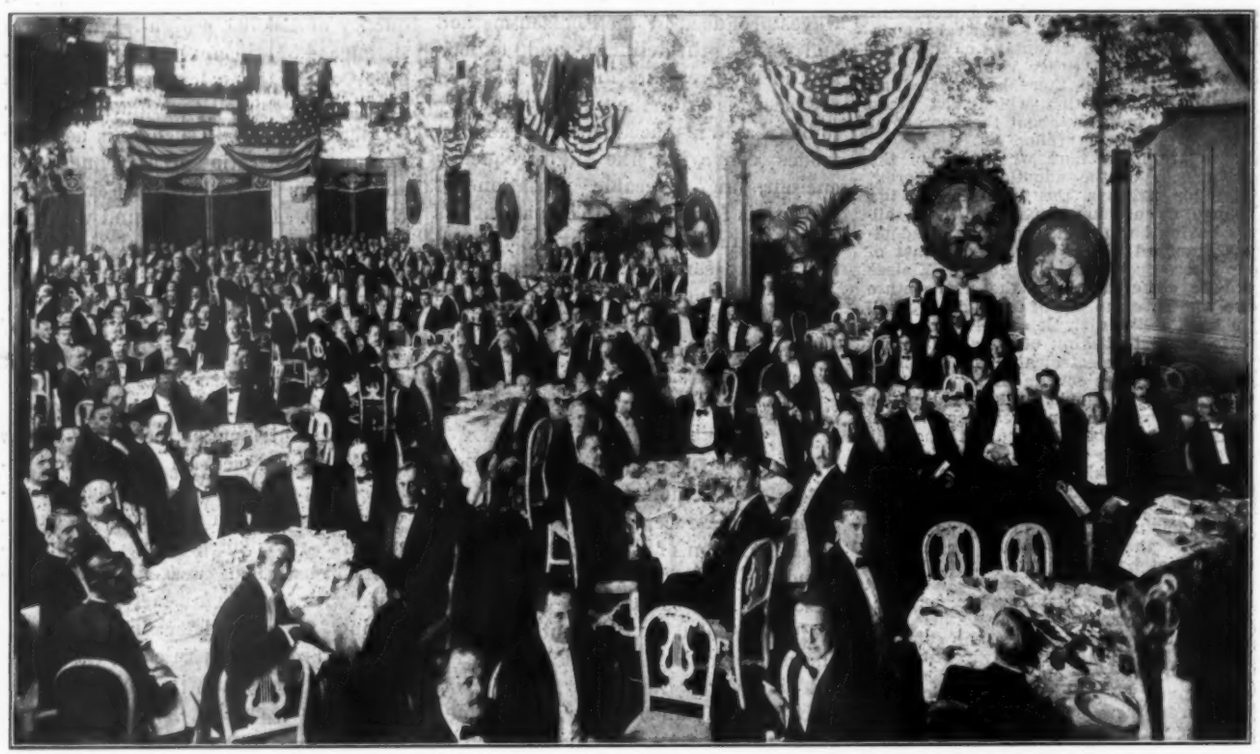
The ninth annual dinner of the alumni of Stevens Institute of Technology will be held at the Hotel Astor, New York city, on the evening of February 12. Among the speakers will be: Dr. Alexander C. Humphreys, president of Stevens Institute, Dr. Henry S. Pritchett, president of the Carnegie Foundation, and Colonel Harvey, editor of *Harper's Weekly*.

Street Railway Dinner.

A dinner was given at the Hotel Knickerbocker, New York city, on the evening of January 28, by the American Street and Interurban Railway Manufacturer's Association to the delegates to the mid-winter session of the American Street and Interurban Railway Association. The speakers were the Hon. James F. Shaw, president of the American Street and Interurban Railway Association, who responded to the toast "The Association"; the Hon. George A. Post, president of the Railway Business Association, who responded to the toast "Railways, Public Opinion and the Equipment Industries"; the Hon. John W. Griggs, ex-attorney general of the United States, who responded to "Electric Railways and the Public," and Charles W. Colby, of McGill University, who responded to "Apropos of Canada," C. C. Peirce, of Boston, presided in the absence of Joseph R. Ellicott, president of the Manufacturers' Association, who was absent due to a sudden illness. A standing toast to Mr. Ellicott's health was given upon Mr. Peirce assuming the chair.

One of the pleasant features of the dinner was the presentation by W. Caryl Ely on behalf of the American Street and Interurban Railway Association, of a fine chest of table silver to B. V. Swenson, the retiring secretary.

Among others present were the following: H. H. Vreeland, John W. Griggs, C. S. Sergeant, Azel Ames, A. H. Armstrong, A. N. Barber, H. A. Benedict, H. W. Blake, W. P. Bauman, J. V. Brady, J. F. Calderwood, C. S. Clark, E. G. Collett, Geo. A. Damon, R. E. Danforth, H. L. Doherty, J. S. Doyle, H. C. Evans, Dudley Farrand, F. W. Frueauff, F. H. Gale, Gen. G. H. Harries, Frank Hedley, D. A. Hegarty, B. A. Hegeman, Jr., George Keegan, Walter C. Kerr. Hart Lyman, W. G. McAdoo, Thos. N. McCarter, R. G. McDuffey, T. C. Martin, Chas. R. Miller, E. F. Peck, C. W. Price, F. C. Randall, G. Tracy Rogers, Orin Root, H. K. Spalding, A. E. Stillwell, C. A. Terry, Calvert Townley, H. H. Westinghouse, W. R. Willcox, E. W. Winter, J. McG. Woodbury.



GUESTS AT THE DINNER GIVEN BY THE AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS ASSOCIATION.

Denver Electric Rates Reduced.

The Denver Gas and Electric Company, of Denver, Colo., has recently announced a voluntary reduction in rates. Dating back to January 1, a reduction of 11.1 per cent on electricity is effective.

Minneapolis Electrical Show.

An electrical exposition will be held in the Armory at Minneapolis, Minn., from March 26 to April 2, inclusive, under the direction of the Northwestern Electrical Show Association.

There are available 15,000 square feet of booth space, and the occasion will be enlivened by special decorations, special days and musical programmes.

The officers of the Northwestern Electrical Show Association are as follows: President, F. C. Dunstin, superintendent city electrical department; vice-president and manager, George J. Cadwell, of Cadwell & Brown, Minneapolis; secretary, C. D. Wilkinson, Western Electric Company, Minneapolis; treasurer, A. W. Leonard, Minneapolis General Electric Company. The directors are W. D. McDonald, Westinghouse Electric and Manufacturing Company; W. F. Smith, General Electric Company, and J. L. Barnard, Bryan-Marsh Company.

A "Monorail" Cable Car.

It is reported that Professors W. E. Brooke and B. L. Newkirk have recently constructed a monorail car, balanced by a single gyroscope. It is intended to give the car a trial on a cable across the Mississippi River.

Annual Meeting of the Central Electric Railway Association.

The Central Electric Railway Association held its fourth annual meeting at the Southern Hotel, Columbus, Ohio, January 27. The attendance was thought to be the largest of any previous meeting held by the association and the interest manifested was a matter of comment. A number of the members came in delegations in special cars from the states of Indiana, Michigan and Ohio.

The annual meeting of the Central Electric Traffic Association was held the day before and the work accomplished during the past year was carefully reviewed. A. L. Neereamer, chairman of the association, was highly praised for his efficient management in the establishment of a successful plan of taking care of interline traffic. The association will give consideration to the development of joint freight traffics during the present administration.

The annual meeting of the Railway Association was called to order by A. A. Anderson, president, who has served with proficiency during the year. President Anderson congratulated the association on the good attendance and the progress made during the year the proof of which he said the members would learn from the secretary's report.

Secretary Neereamer submitted a lengthy report in which it was shown that the year had been the most prosperous during the life of the association. The membership of the association consists of forty-seven lines having a total mileage of 3,331 miles, an increase of four roads and 131 miles over the preceding year. There was also an increase of twenty members in the supply men's and publicity department. The report shows the association to be in an excellent financial condition and the future of the association as it relates to the expense account is no longer doubted.

G. H. Kelsey, chairman of the committee on the advisability of establishing a centralized testing laboratory, reported that it was the opinion of the committee that the association is in a position to furnish to its member companies a great deal of information as to the merits and quality of various materials and equipment which is required, if there was instituted a systematic and careful collection of such information and made available for distribution. The committee, therefore, recommended the collection and distribution of information relative to the results of tests made under physical and chemical processes.

The reports of a number of other committees were deferred until the March meeting and the regular programme taken up.

A paper prepared by T. B. McMath, chief engineer of the Indianapolis Traction and Terminal Company was read. Mr. McMath's paper was very instructive, dealing with the best method of track laying and the paving of the roadway adjacent to the rails and the best and least destructible material to use.

In the discussion of this paper a number of the members detailed experiences with paving the tracks and named the materials giving the best satisfaction.

Considerable interest was manifested in the subject and matter of a paper read by H. H. Buckman, master mechanic of the Louisville and Northern Railway and Lighting Company, on "Daily Inspection and Up-keep of Rolling Stock." Mr. Buckman said the subject was one of the most important branches of service relating to the economical operation of electric railways and should be handled with care and system by the shop forces and inspectors. Mr. Buckman detailed the manner of best organizing this branch of the service and drawing largely from his own experiences explained in an interesting way how best to keep in repair the rolling stock of the companies. This paper was received with enthusiasm and those who freely discussed the paper piled up a number of inquiries which at the close of the discussion were answered very satisfactorily by the writer.

Col. C. C. Williams, of Columbus, Ohio, gave an interesting talk from a legal standpoint relating to the proper and safe course for trainmen to pursue when passengers refuse to pay the regular fare. He said electric roads had the right to make regulations for the comfort and safety of passengers and also as to the method of payment of fare. The new pay-as-you-enter system and the rule requiring passengers to pay an excess fare when not provided with tickets were upheld by the courts where conditions favored such compliance. The plan Mr. Williams suggested was to require the passenger to pay the excess fare and give a receipt for the amount and the passenger could then collect the rebate if the company was at fault.

Colonel Williams cited many incidents of ejection from trains and the causes therefore and advised how the courts had ruled in contested cases. There was no discussion of this paper but a hearty vote of thanks given to Colonel Williams for having instructed the members in their legal rights in this respect.

The afternoon session was opened with a talk by Judge O. P. Gothlin, chairman of the Ohio Railroad Commission, on the "Relation of the Commission to Interurban Roads." He said the duty of interurban roads to the public was paramount. The public was entitled to safe and adequate service at reasonable rates. He said it was little short of criminal negligence for traction companies to employ inexperienced officials and employes. He urged that the safety of travel be not sacrificed for high speed records and advised that managers should insist that trainmen observe the rule to slow down in rounding the curves and at obstructed points. Judge Gothlin said the commission was giving considerable attention to derails and grade crossings and said there was injustice in throwing all responsibility on the electric lines at crossings with steam roads. He said there was no excuse for inadequate service and warned the interurban managers to see to it that adequate and comfortable cars were run so as to accommodate the public. He said the time was near at hand when steam roads could not refuse to interchange traffic and equipment with the traction lines. O. H. Hughes and C. L. Sullivan, members of the commission, gave short talks on rules and the necessity of their proper observance.

The election of officers resulted as follows: George Whysall, president; A. W. Brady, vice-president; W. S. Whitney, vice-president; A. L. Neereamer, secretary-treasurer. For the executive committee the following were named: In Indiana—A. A. Anderson, C. L. Henry, H. A. Nicholl, C. D. Emmons, and J. H. Crall. In Ohio—F. D. Carpenter, E. F. Schneider, S. D. Hutchins, C. M. Paxton, F. W. Coen. In Michigan—F. W. Brown, and J. F. Keys, and in Kentucky, M. J. Insull.

The meeting adjourned to meet in South Bend on the fourth Thursday of March, 1910. S.

Joint Meeting in Chicago of Western Society of Engineers and American Institute of Electrical Engineers.

On the evening of January 26 there was held the fourth of the present series of monthly joint meetings of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers. The meeting was called to order in the rooms of the latter society in the Monadnock Block, Chicago, by W. B. Jackson, chairman of the Electrical Section during 1909. Secretary Warder read the list of nominees for officers of this section for the present year. These were unanimously elected; the new officers are: Geo. H. Lukes, chairman, G. T. Seeley, vice-chairman; P. B. Woodworth, member of the executive committee for three years. The suggestion to change the date of the meetings to the fourth Wednesday of each month was adopted and the plan of continuing the meetings as joint meetings with the Chicago Section, A. I. E. E., was heartily approved.

The main portion of the evening was devoted to an illustrated lecture and demonstration on the "Recent Developments in the Automatic Telephone," by Lee Campbell, general superintendent of the Automatic Electric Company, Chicago. With the aid of some diagrams and other lantern slides and an array of automatic equipment Mr. Campbell gave an excellent idea of the main principles of automatic telephony and impressed on his hearers that the seeming complexity of the system was no impediment to the reliability and efficiency of its operation.

Among the recent developments in the automatic telephone were the perfection of a straight two-wire system, simplification of the calling mechanism, utilization of relatively simple automatic line switches to pick out the idle first selector switches, and the growing use of small local branches or district exchanges. These features have helped materially to increase the possible number of telephones in, and the area covered by, any exchange system, and at the same time permitted a reduction in the investment required. By the two-wire system the necessity of having a ground connection for calling purposes is eliminated. The calling mechanism is now compacted into a small dial mounted directly over the base of desk telephones; this may be added to many other types of telephone in use. The line switches operate the instant the receiver is removed from the hook and permit a decided reduction in the number of selector or connector switches. Local branches permit the subscribers' lines to be relatively short and thus afford a decided saving in the wire and cable plant investment. Mr. Campbell referred to a number of exchanges in which the local branch idea has been carried out. Among these were Los Angeles, with 30,000 lines, San Francisco and Oakland, Cal., Columbus and Dayton, Ohio. The local branches usually have 500 or 600 lines.

At the close of Mr. Campbell's lecture a working demonstration of the automatic system was made. For this purpose there was used a section of an automatic switchboard containing a group of line and connector switches and other auxiliary apparatus. A number of automatic instruments of both desk and wall types were placed in different parts of the lecture room and connected to the "girl-less" switchboard.

After the demonstration and inspection of the apparatus, a general discussion on automatic telephony was opened by C. S. Winston, chief engineer of the Kellogg Switchboard and Supply Company, Chicago, who called attention to the fact that some of the earliest automatic patents were taken out nearly thirty years ago, but the greatest development in this line was in the last decade. Regarding the future many telephone engineers believe that a combination of both the manual and automatic systems, either in the semi-automatic or automanual forms, will receive much utilization. In the semi-automatic type the answering jacks are removed from the board and the calls come before the operators progressively from one end of the board, thus permitting the employment at any part of the day of only enough operators to properly handle the traffic passing through the office at the time. In the automanual system the art of automatic calling is performed by the operator in accordance with the orders of the subscriber, thus preventing errors on the part of the latter and simplifying the automatic equipment.

A. M. Haubrich, of the Stromberg-Carlson Telephone Manufacturing Company, expressed doubt of the possibility of ever substituting automatic equipment entirely for the manual systems now in use, first, because of the desirability of keeping some human link in the operating mechanism, and, second, because of the great investment now tied up in manual switchboards which he thought it would be folly to discard. He saw some marked advantages in the semi-automatic system, however.

Frank F. Fowle, consulting engineer, said that the development of the small local branches that require no attendant whatever has effected a saving of some seventy-five per cent in the investment in subscribers' lines and the cable plant. In the full manual system about three-fourths of the entire investment is for the wire and cable equipment. The increased cost of the automatic switching outfit is made up by the above saving and by the saving in operating cost. Among the advantages of the automatic system are the better opportunity afforded for accurate measurement of the traffic and the better character of the service rendered, both as to speed and reliability.

T. E. Meyer and N. L. Johnson, of the Automatic Electric Company, called attention to other advantages of the automatic telephone. One point is the satisfaction that the subscriber has in knowing that when he cannot get a certain desired connection it is because the line is busy or the party does not answer; in each case the characteristic signal is heard. The seeming difficulty in making tests is not met with in practice; on the contrary, all problems in testing have been solved and the tests are made quicker and more satisfactorily than in the manual system. The problems associated with toll service, party lines, private exchanges, etc., have also been solved.

Messrs. Bellfield, Lake and Bement also participated briefly in the discussion, which Mr. Campbell closed by stating that the rates in vogue where district stations are used are not much different from other similar rates. But the savings effected by the district branches permit almost unlimited extensions without increasing the rates, something that is now impossible with the manual system. The depreciation of automatic equipment has not been determined, but he believes it to be small, in fact, less than with manual equipment. The switch wipers and contacts receive the greatest wear and can be easily replaced at low cost. Private branch service can be carried on as now, or entirely automatically.

Charles F. Brush Visits His Old Laboratory.

It was in 1881 that Charles F. Brush built his private laboratory and office, at what was later known as the Brush plant, in Cleveland, Ohio.

Between that time and 1892 he worked out some of the really important practical problems which so greatly accelerated the growth of the electrical business, when the need was great for devices of a fundamental character.

Mr. Brush visited his old laboratory on December 13, 1909, and inspected with keen interest every nook and corner which told again the story of his early work. He found still in use some of the benches which were built in 1881. In a reminiscent way he pointed to one side of a basement room, saying that on that spot he calibrated and tested the first practical, workable voltmeter and ammeter, made under his direction in the shops across the street. These original instruments he treasures in the laboratory maintained at his home, where he devotes a considerable portion of his time to scientific investigation.

During the visit, he pointed to another part of the laboratory, where he developed his first storage batteries, and told many interesting anecdotes of his first experimental installations of arc lamps for test purposes. His hosts were greatly impressed to have these early experiences related by the founder of commercial arc lighting, who has lived to see its present day development.

The visit of Mr. Brush to his old factory was made more interesting by his many anecdotes which in a way served as an illustration of the tremendous growth of the electrical industry.

Probably no more striking illustration of this growth in the past few years can be given than the fact that the Brush Electric Company's plant, which ranked as a great electrical works in 1893, covering five and one-half acres, and manufacturing everything electrical, from dynamos to incandescent arc lamps, is now devoted to the manufacture of incandescent lamps alone. The fact that this plant was considered enormous then, is an illustration of the rapid development of this industry, when we consider that in the manufacture of incandescent lamps alone, the member companies of the National Electric Lamp Association occupy here a factory floor space of over thirty-five acres, and employ over 6,000 people.

Charles F. Brush, President Charles S. Howe of the Case School of Applied Science, and H. R. Hatch were the guests on the occasion above referred to, of Doctor Hyde, director of the physical laboratory of the National Electric Lamp Association. Doctor Hyde and his associates now occupy this historical laboratory, which has been remodeled and equipped for scientific research on the physics of light, the physiological and psychological phenomena of illumination, and the study of color values and color effects.

Mr. Brush expressed great pleasure in finding the scene of his earliest work again the home of scientists pledged to original research, aimed directly at increasing the sum total of human knowledge on light and illumination.

New York Section, Illuminating Engineering Society.

The next (February) monthly meeting of the New York Section, Illuminating Engineering Society, will be held Thursday evening, February 10, in the Engineering Societies Building, New York city. The paper of the evening will be "School Room Lighting," by George W. Knight, supervising engineer, Board of Education, Newark, N. J., and Albert J. Marshall, consulting illuminating engineer. There will also be sent to the members of the section, a folder on which will be printed a floor plan of a general store, together with descriptive data relative to same, for the purpose of having the members suggest what, in their opinion, are the most desirable lighting units, treatment and placement to produce the most satisfactory lighting effects. These folders are to be brought to the meeting, and the various systems discussed.

At the March meeting Messrs. Clifford, Ives and Ryan will lead a topical discussion on "Decorations, Fixtures and Color Value."

At the April meeting a paper on "Lighting Fixtures" will be presented by Messrs. Hopton and Watkins.

January Meeting of the Technical Publicity Association.

The thirty-fifth monthly dinner and meeting of the Technical Publicity Association, held in New York city, was another "open" meeting. C. R. Lippmann, of Easton, Pa., suggested methods whereby members of the association collectively could gather a vast amount of advertising and merchandising information. He also suggested the desirability of interesting the heads of firms more in advertising.

H. M. Horr, advertising manager of the Oakland Chemical Company, spoke about "Direct Mail Advertising" and the benefits of "circularizing" by form letters. He pointed out that by far the greatest percentage of form letters sent out is surprisingly ineffective. Others who spoke were Geo. W. Wharton, H. Tippet and Barrett Smith.

Subsequently an energetic discussion on the uniform advertising contract proposed by the committee was carried on. The proposed contract will again come up for final action at the next meeting, February 10th.

Engineers' Society of Western Pennsylvania.

The thirtieth annual meeting of the Engineers' Society of Western Pennsylvania was held in the society rooms, Fulton Building, Pittsburg, on January 18, with E. K. Morse, who succeeded to the presidency on the death of Geo. T. Barnsley last October, presiding. The annual report of the board of direction, including the reports of committees, sections, and the treasurer, was read. This indicated the general prosperity of the society during the past year. The membership of the society at the close of the year was 835. The following officers were elected for the ensuing year: E. K. Morse, president; J. O. Handy, vice-president; A. E. Frost, treasurer.

The annual banquet of the society was held Saturday evening, January 29, in the Fort Pitt hotel. Among the speakers were Geo. H. Neilson, toastmaster; President E. K. Morse; Dr. J. A. Holmes, director technologic branch of the United States Geological Survey; Rev. Dr. Maitland Alexander; Geo. C. Johnston, and Frederick L. Bishop, of the University of Pittsburg.

Buffalo Electrical Contractors.

The annual meeting and banquet of the Electrical Contractors' Association of Buffalo was held on the evening of January 29, at the Lafayette Hotel, Buffalo, N. Y. The election of officers for 1910 resulted in the choice of the following: H. I. Sackett, president; C. F. Sterns, vice-president; E. Fleming, secretary; E. P. McCormick, treasurer; J. C. Sterns, state director.

Next Convention in St. Louis.

The executive committee of the National Electric Light Association has decided to hold the next annual convention at St. Louis, Mo., May 23 to 28, with headquarters at the Coliseum. A formal invitation was received from the League of Electrical Interests of St. Louis, and there is every indication that this convention will be most successful, especially as it marks the twenty-fifth anniversary of the association. The Coliseum is a steel and concrete building, somewhat resembling Madison Square Garden in New York, and provides excellent facilities for meeting purposes as well as being ideal for exhibition purposes. In view of the extraordinary large growth in membership since the last convention, it is believed that record numbers will be reached upon this occasion and active measures are already being taken in St. Louis to give the association a welcome.

A Cadmium Storage Battery.

In a recent issue of the *Zeitschrift fur Schwachstromtechnik*, of Munich, Bavaria, Herr Gernsbach describes a form of storage battery which is claimed to be superior to the ordinary lead cell, especially for laboratory use.

This battery is made in the following way: The negative plate of a completely discharged lead storage battery is replaced by a thin piece of sheet lead, and the battery thus altered is recharged, the thin negative plate not beng charged, insomuch as it lacks the necessary porosity. A plate of cadmium is then placed in the electrolyte so as to make good contact with the thin lead, thereby making an element having an electromotive force of two and one-third volts. While the lead and cadmium are in contact the cell can be discharged in the usual way, the cadmium being dissolved at the rate of about one kilogramme per 1,000 ampere-hours. The cadmium should be taken out when the cell is not in use.

New York Electrical Contractors Elect Officers.

At the recent meeting of the Association of Electrical Contractors of New York, which was held at Utica, the following officers were elected: President, Edmund D. McCarthy, Buffalo; vice-president, C. A. Christensen, New York; treasurer, James T. Burns, Schenectady; secretary, George W. Russell, New York.

Report of Holyoke, Mass., Gas and Electric Department.

William H. Snow, manager of the Gas and Electric Department of the city of Holyoke, Mass., in the seventh annual report of the department, gives much data of general interest regarding this municipal plant.

This city has a modern and well equipped plant, and the degree of success may be judged by the fact that in 1909 their business was 50.8 per cent greater than in the preceding year. Although additions have been made to the plant with a view of accommodating this business, it may be necessary to make even greater enlargements. During the year, eleven miles of new wire was strung and 474 meters added.

A few figures taken from the report will show something of the amount of business which was carried by the department in the past year:

Current sent out, kilowatts	7,410,870
Total number of customers	1,585
Power customers	167
Miles of wire	197 4/5
Number of poles	2,183
Transformers in use	269
Meters set	1,876
Commercial arc lamps	468
Street arc lamps	530
Street incandescent lamps, 60 candle-power, tungsten	8
Street incandescent lamps, 32 candle-power, tungsten	2
Street incandescent lamps, 30 candle-power, tungsten	8
Street incandescent lamps, 16 candle-power, tungsten	33
Steam coal used, tons	9,565

It is worthy of note that the net price of electricity for lighting is six cents per kilowatt-hour.

The working account of the department as concerns the electrical consumption is shown in the following table.

EXPENSES.

Coal	$41,585.06	
Oil and waste	465.76	
Supplies	11,719.84	
Repairs	17,106.85	
Water power rental	13,733.50	
Pay roll	38,885.70	
Office expenses	2,441.94	
Insurance	824.80	
Miscellaneous	1,214.96	
		$127,978.41
Bad debts	155.43	
Interest	17,975.30	
Depreciation	20,063.00	
		38,193.73
		$166,172.14
Profit and loss		25,545.31
		$191,717.45

INCOME.

Electricity	$191,717.45

The balance sheet shows the cost of the electric plant up to November 30, 1908, as $690,583.65, which, plus additions and extensions made in 1909, amounts to $745,619.28. When depreciation is taken out the value of the plant is left at $726,657.28. Up to date the city of Holyoke has invested $1,070,631.61 in this municipal plant. The above results make a very satisfactory showing on the whole.

No Paris-London Wires.

Owing to the recent flood of the Seine telegraphic communication between Paris and London was at one time practically cut off. Some of the reporters of the London papers found it necessary to forward reports to New York over French lines. The message was then sent to London, this operation costing about twenty-five times the ordinary rate between the two cities.

Three-cent Fare in Cleveland.

The three-cent fares which are now in operation on seven of the lines in the city will continue until February 17, when an election will be held on the new franchise. Owing to the expiration of franchises on these seven lines on January 27, five-cent fares could no longer be legally charged. The city and railway company, therefore, agreed on the temporary three-cent rate. It is estimated that the company will lose $30,000 by the reduction.

Control of Wisconsin Waterpowers.

The various opinions held by the legislative committee on waterpowers, forestry and draining, which was appointed by the Wisconsin Legislature have prevented any action from being taken to protect the resources of the state. One of the factions of the committee is in favor of complete control, others desire partial control, while the opinion of the third faction is for a merely nominal supervision. It is probable that two reports will be made. The following are members of the committee: Senators Paul O. Husting, Henry Krumrey, and H. P. Bird; Assemblymen George P. Hambrecht, W. M. Bray, F. W. Kubasta and J. E. Thomas.

Massachusetts Trolley Merger Again Planned.

Another effort will be made to consolidate all the street railway lines west of the Connecticut River in Massachusetts under the control of the New York, New Haven & Hartford Railroad, through a bill introduced in the legislature by Representative Tytus. Mr. Tytus presented a similar measure last year, but it was not approved.

Copper exports for the week ended January 27 were 6,710 tons. Since January 1 they were 23,115 tons, compared with 18,470 tons the same period last year.

THE DESIGN OF CONSTANT-POTENTIAL TRANSFORMERS.

BY W. T. RYAN.

PART I—DEVELOPMENT.

The alternating-current transformer in its simplest form consists of one magnetic circuit interlinked with two electric circuits, one of which (the primary) receives, and the other (the secondary) delivers, electrical energy.

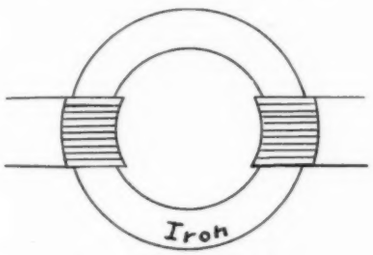


FIG. 1.—FARADAY'S RING.

Faraday's iron ring (Fig. 1) with which he made the initial discovery of electromagnetic induction. Faraday's initial transformer consisted of an iron ring about seven-eighths inch thick and six inches in external diameter. On one side were wound a number of turns of wire separated by twine and calico. On the other side of the ring, but separated from the first winding by an interval, was placed a second winding. He found that when the connection of a battery to the first winding was broken an electromotive force was induced in the second winding.

Since the lines of force not only pass through the iron but to some extent through the air (Fig. 2), it follows that only a part of the magnetic flux in the primary coil actually threads through the secondary coil, the rest closing around the primary coil in air. The

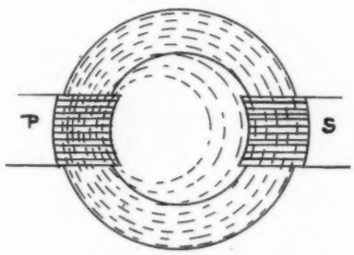


FIG. 2.—DIAGRAM ILLUSTRATING MAGNETIC LEAKAGE IN A TRANSFORMER.

then be sufficiently large to tend to produce a field equal to but opposed in direction to the field which the current in the secondary tends to produce, and in addition it must produce the actual flux present in the transformer. The primary coil, therefore, drives a magnetic flux in a certain direction

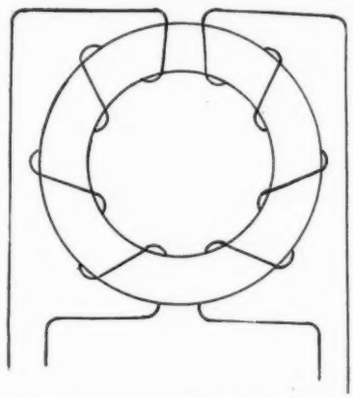


FIG. 3.—SPREADING OF COILS TO REDUCE LEAKAGE.

In following out the stages of development of the transformer, we find that improvements have been made by a process of evolution in which rudimentary forms were successively replaced by more and more completely developed designs. The prototypical form of all modern transformers is

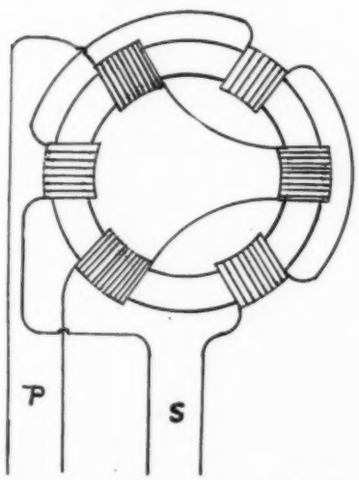


FIG. 4.—SUBDIVISION OF COILS TO REDUCE LEAKAGE.

difference in flux in the primary and secondary coils will be greater the farther the coils are from each other and the greater the reluctance of the iron circuit. The result is that a portion of the lines of force are caused to leak out laterally and produce a leakage field which does not in any way contribute to the production of electromotive force in the secondary coil. The arrangement of coils in Fig. 1 is bad on account of their great distance. It does not give a strong magnetic flux through the core if a large current be taken from the secondary.

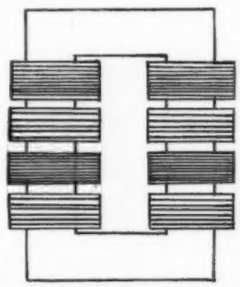


FIG. 5.—SUBDIVIDED COILS ON RECTANGULAR CORE.

The conditions which influence leakage can best be understood by assuming that the primary coil carries a continuous current, whilst through the secondary there passes either no current, or also a continuous current in such a direction as will tend to weaken the field produced by the primary current. The primary current must

through the core. If no current flows in the secondary then the lines of force have only the reluctance of the iron path to overcome which will be so small that only a few of the lines of force will be crowded out. If, however, the secondary also carries a current it will tend to produce a flux in the opposite direction, which colliding with the original flux causes considerable leakage, thus weakening considerably the flux actually passing through the secondary coil. This reasoning applies to the case of alternating currents provided that the change

FIG. 6.—COAXIAL COILS ON RECTANGULAR CORE.

in direction occurs in both coils nearly simultaneously, a condition which is always fulfilled in transformers working under load.

With the arrangement shown in Fig. 1 the leakage is very large. The design may be improved by spreading each of the coils over one-half of the circumference, as shown in Fig. 3. As

regards leakage this is an improvement over Fig. 1. The improvement may be carried still further by subdividing each coil into several parts. Fig. 4 shows six separate coils arranged to cover the ring uniformly, and connected alternately with the primary and secondary circuit. The leakage field is now only about one-ninth of its previous value. If, instead of subdividing each coil into three parts, it were subdivided into four, the leakage would be only one-sixteenth of its previous value, etc. By carrying the principle of subdivision far enough the leakage field may be reduced to such an extent that its effect is practically negligible.

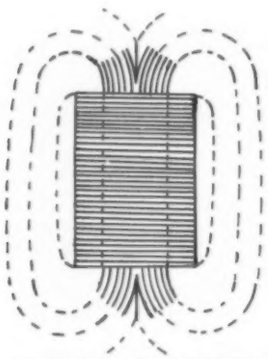


FIG. 7.—HEDGEHOG TRANSFORMER.

For geometric and practical reasons the shape of the magnetic link was changed from a circle to a rectangular frame and the coil placed on the two longer sides of the rectangle (Fig. 5). In the arrangement shown in this diagram, the primary winding is subdivided into four coils which alternate in position with the four coils of the secondary winding. A more usual and equally effective arrangement as regards leakage consists in placing the coils axially within each other (Fig. 6). This reduces the number of coils to be wound and handled and simplifies the insulation between the primary and secondary coils.

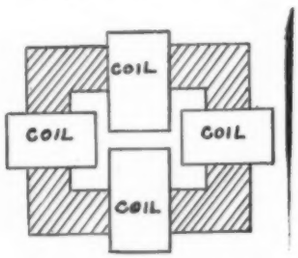


FIG. 10.—DISTRIBUTED COILS—LATE FORM (ENGLAND).

One of the early investigators, J. Swinburne, introduced the so-called "hedgehog" transformer (Fig. 7) with the intention of reducing the iron loss. He placed the coils upon a core consisting of a bundle of iron wires with their ends spread out like the back of a hedgehog. The lines of force passing through the core must complete their path through air, as shown in the diagram. Hysteresis loss takes place only in the small quantity of iron which forms the core proper. The actual iron loss is very little, if any, less than it is in the closed magnetic circuit types. This type of transformer requires an exceedingly large exciting current. With the secondary open the primary current may be as much as fifty per cent of full-load current, whereas in the closed magnetic circuit types it is only a very small fraction of the full-load current. This type of transformer did not prove itself successful in practice.

FIG. 8.—SHUTTLE TRANSFORMER.

One of Rankin Kennedy's early specifications, describes a transformer made with a shuttle-shaped core (Fig. 8) constructed out of a pile of iron stampings, insulated from one another and pressed together over which were wound the primary and secondary windings. The magnetic circuit was completed by winding iron wires over the shuttle-shaped coil, the direction of such windings being perpendicular to the axis of the core.

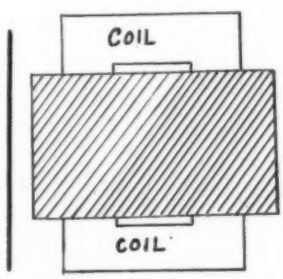


FIG. 11.—DISTRIBUTED MAGNETIC CIRCUIT.

Transformers now in use may be divided into two great groups:

I—Those with distributed coils.

II—Those with distributed magnetic circuit.

The types shown in Figs. 9 and 10 belong to the first group, and those shown in Figs. 11, 12, 13 and 14 belong to the second group. Which of the two general types is the better cannot generally be decided upon, but depends on a variety of circumstances.

With distributed coils the weight of iron is small and the length of the turns of wire is short. The path of the flux, however, is very long, hence the number of turns is large, since the number of ampere turns required to produce the flux is large. The total weight of copper is therefore rather large, but the coils are accessible, and more exposed to the cooling effects of the oil.

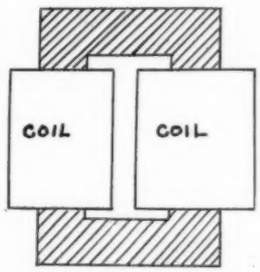


FIG. 9.—DISTRIBUTED COILS.

With a distributed magnetic circuit, the length of the magnetic circuit is short, hence fewer ampere turns are required to produce the flux. The coils have fewer turns, but much longer turns. The total weight of copper is, however, rather small. It permits of a simpler and better mechanical construction, since the coils are protected from mechanical injury. It requires more iron, thus increasing the iron loss and making it difficult to get a high all-day efficiency. The coils are not readily accessible or so well exposed to the cooling effect of the oil. The

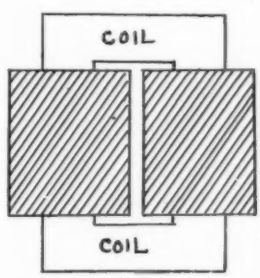


FIG. 12.—DISTRIBUTED MAGNETIC CIRCUIT.

leakage flux is a little larger than with the other type, thus tending to make the regulation a littler poorer. If the transformer is damaged by lightning, repairs are more easily made. If a damaged distributed-magnetic-circuit transformer is repaired "on the ground" it will usually be found impossible to replace all the iron. This simply means more iron loss, higher

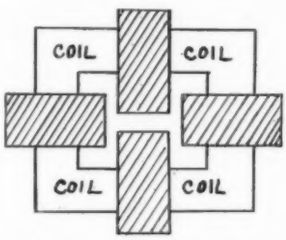


FIG. 13.—DISTRIBUTED MAGNETIC CIRCUIT —LATE FORM (WESTINGHOUSE).

temperature rise and hence a little lower efficiency. With the distributed-coil type, especially the smaller sizes, it will often be found impossible to replace all of the wire. This means that not only the temperature rise is increased and the efficiency lowered, but the ratio of transformation is changed,

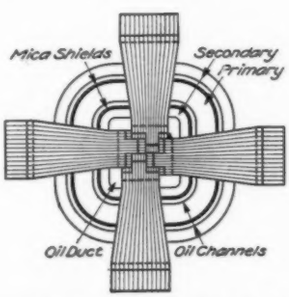


FIG. 14.—DISTRIBUTED MAGNETIC CIRCUIT —LATE FORM (G. E. COMPANY).

hence the voltage available at the secondary terminals is no longer the same.

The later types give a better opportunity for getting away from the old so-called "mummifying" methods of insulating which formerly prevailed in transformers, and the making use of "skeletonized" constructions and heat dissipating and impregnating compounds. The coils can be made up so as to constitute rigid cylinders which may be slipped off the winding form and upon the iron core of the transformer. The core may be separated from the windings and the windings from each other by fibrous strips, thus leaving channels for the air or oil to circulate through. A cylinder of micanite or other material may be slipped in between the primary and secondary windings, and this in turn may be separated from the windings by insulating strips providing still more channels for the air and oil to circulate through. Wrapping should be avoided and distance strips freely employed as far as practicable, in the interests of obtaining good surface radiation and avoiding great depths of unventilated windings.

A good transformer of any type must have the core losses, copper losses, regulation and quality of insulation correctly proportioned in order to secure the best average results.

(To be continued.)

Chicago Electric Club.

The last meeting of the Chicago Electric Club's fiscal year was in the form of a "Dutch Lunch," held at the Chicago Automobile Club on January 26, and the attendance on this occasion demonstrated that these informal affairs met with the approval of the members.

Incidental to the coming annual election of officers the reports of the various committees were presented. The

EMBLEM OF THE CHICAGO ELECTRIC CLUB.

report of J. G. Pomeroy, treasurer, showed a balance on hand of $2,049. During the past year ninety-nine new members have been enrolled.

H. F. Holland, chairman of the membership committee, reported that the present committee has a list of prospective members to turn over to the new committee.

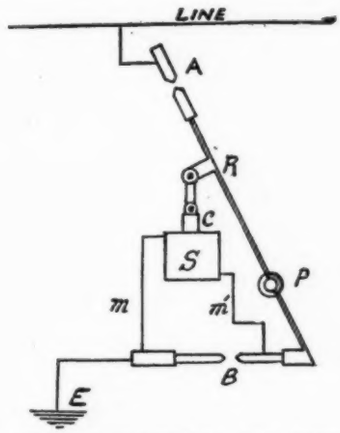
W. E. Keily, who is chairman of the committee which has been considering the recommendations of Former-President C. A. Howlett regarding the publishing of the club's procedings and the formation of a national association of electric clubs, suggested that the first recommendation be not acted on. The second, however, was considered favorably and action will be taken.

F. S. Hickok, who has been working on another of Mr. Howlett's recommendations, namely, an emblem for the club, submitted the design illustrated herewith, which upon motion was adopted.

Following these reports several of the members were called upon for short remarks appropriate to the occasion.

Lightning Protector for High-Tension Aerials.

La Energia Electra describes an interesting form of lightning protector for use with overhead lines of transmission pressures up to 50,000 volts. The accompanying figure indicates the arrangement. A connection is made from the line to a spark gap A, the lower point of which is fixed to an inclined balanced rod R, pivoted at P. At the foot of R is one terminal of a second spark gap B, which is in series with A. The fixed terminal of B is connected direct to earth. S is a solenoid



LIGHTNING PROTECTOR FOR HIGH-TENSION LINES.

shunted across the spark gap B, and M and M' are flexible connections. C is a plunger working in the solenoid; the plunger is linked to the balanced rod at R.

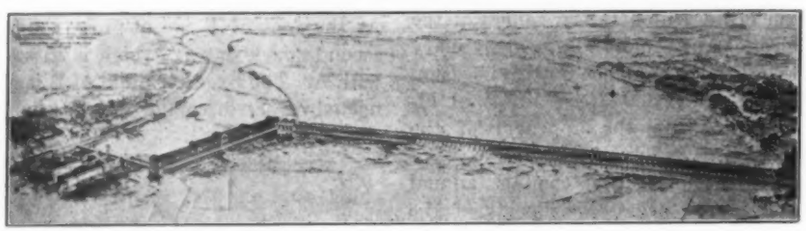
The action is as follows: When the surge takes place it sparks across at A and at B and goes to earth, the solenoid being unaffected by the high-frequency currents. Once there is an arc at A the line current follows the surge, and having only a low frequency it finds the gap at B of higher resistance than the solenoid; it therefore passes through the latter to earth. In passing through the solenoid the current causes the core C to be sucked down, thus increasing the gaps at A and B until the arc is broken.

CENTRAL STATION PRACTICE

Transmission—Interior Wiring.

The Keokuk Power Development on the Mississippi River.

Work was begun some few days ago on one of the largest hydroelectric power developments of the country. At Keokuk, Iowa, the Keokuk and Hamilton Water Power Company has begun construction work preparatory to the building of a great dam across the Mississippi River. The project is financed by eastern capitalists and is estimated to cost not less than $14,500,000. It will require at least thirty months or three years to complete, and the plans are to develop 200,000 horsepower, of which 60,000 has already been engaged by three large public service corporations of St. Louis, Mo.



POWER PLANT AND DAM AT KEOKUK, IOWA, AS THEY WILL APPEAR WHEN COMPLETED.

The dam will be one of the largest in the world—5,800 feet in all, the main dam 4,400 feet and the power house 1,400 feet, and the government canal, which cost about $7,000,000, will be submerged. The dam, of reinforced concrete construction, will be thirty-seven feet high, the lower seven feet being imbedded in the rock of the river bed. Engineers Hugh Cooper and W. V. N. Powellson ,of New York, are in charge. It is estimated that at least $1,000,000 worth of land on the Illinois and Iowa shores between Keokuk and Burlington, Iowa, will be flooded when the dam is complete, and options on the greater part of this property have already been secured. The present power plant of the Keokuk Electric Light and Power Company is on land to be flooded, and if the company remains in business it will be obliged to move its plant. The accompanying diagram shows the dam construction.

FIRST LOCK, DES MOINES RAPIDS CANAL, KEOKUK, IOWA.

New Power Plant in Italy.

The firm of Escher, Wyss and Company, of Zurich, Switzerland, says *Engineering*, of London, England, is at present installing the turbines and pipe lines for the Adamello power plant, in northern Italy. This station will generate about 28,000 horsepower under a gross head of 3,060 feet.

The water is supplied by a river, which has its source in a small lake situated in the Adamello Mountains, Italy, not far from the Austrian frontier, and called Lago d'Arno. The river has a total fall of 4,600 feet, and the upper portion of this is being utilized first. The installation is expected to start running next year.

Two pipe-lines, each about 1,650 yards long, are to lead the water down to the power station; the outside diameter of the pipes varies from three feet to two feet, and their thickness varies between five-sixteenths of an inch and one-and-five-sixteenths inches. The upper portion of each pipe line consists of riveted pipe sections, the lower part of welded sections, the material being Siemens-Martin open-hearth steel. The stress under normal pressure varies from 8,500 pounds to 11,400 pounds per square inch.

Four generator-turbines will be installed, each calculated to develop 6,600 horsepower, working under a 3,000-foot head, and running at a speed of 420 revolutions per minute. The turbines are of the one-jet, high-pressure, impulse type, the jet having a diameter of about three inches. The turbines are fitted with deflecting nozzles.

The installation is completed by two exciter turbines, each calculated for 500 horsepower. The design of these is similar to that of the generator-turbines. The jet for these smaller turbines is about one inch. The whole of the hydraulic machinery, including the pipe line, is supplied by the Zurich firm.

Power Developments at Niagara Falls.

In a paper read by Prof. R. W. Angus on December 4, 1909, before the Canadian Institute, the following particulars were cited of the electrical developments at Niagara Falls:

The total fall between Lake Erie and Lake Ontario is 326 feet. This is made up mainly as follows: Buffalo to Chippewa, fourteen feet; Chippewa to crest of falls, fifty-five feet; Niagara Falls, 158 feet; cantilever bridge to Lewiston,

ninety-five feet. On the supposition that the entire load of 326 feet can be utilized, the total development is placed at about 5,000,000 horsepower. The falls alone represent about one-half of this amount, or 2,500,000 horsepower. Charters have been granted for the use of 705,000 horsepower, which is taken, for the most part, from just above the main falls and discharged just below them. The first charter was granted in 1879 to the Hydraulic Power and Manufacturing Company, but little or none has been developed for sale. Of the remaining developments, the Canadian Niagara Power Company, organized in 1892, together with the Niagara Falls Power Company (1894), have charters for 300,000 horsepower; these two companies are controlled by the same group of financiers. The Ontario Power Company, which will supply the Ontario Government with power for distribution to the municipalities, has charter rights up to 180,000 horsepower, and the Electrical Development Company (1903) for 125,000 horsepower.

Electricity in Venezuela.

The rate charged per month for arc lights at Caracas is $17.01; and eleven cents per kilowatt hour. Incandescent lights of sixteen-candlepower, all-night service, $1.15 per month. The Government is granted a discount on these rates of twenty-five per cent. No special contracts are made with large consumers. All bills are payable on the first of the month without discount.

The electric lights of the City of Caracas are supplied by the Compañía Anónima de Alumbrado Publico from two plants, in one of which, the Junin, 200 horsepower is developed from gasoline motors, and 1,000 horsepower is taken from the plant of the Compañia Anónima La Electricidad de Caracas, at Encantado, distant 9.6 miles, and from Los Naranjos, twelve miles. The El Paraiso plant has two gas motors of seventy-horsepower each and one of 140-horsepower, this plant also making coal gas and supplying the city. The electric-light plant Junin is equipped with General Electric, Thompson-Houston, and Westinghouse machinery, while the machinery in the Paraiso plant is from Germany.

The power developed by the Compañia Anónima La Electricidad de Caracas amounts to 600 horsepower at Encantado and 2,000 horsepower at Los Naranjos. A new plant to develop 1,000 horsepower is being put in about two miles below Los Naranjos on the Guaire River. There are about 150 power motors of all classes, according to the acting consular agent in Caracas, and they pay ten cents gold per horsepower per hour for power. The power company makes use of the waterfalls on the Guaire, using a Francis wheel at Encantado and Pelton wheels at the other two plants. The capitalization of the power company is $579,000. The company proposes extending its plant. The plans and specifiations for machinery, etc., were taken to Europe in June by a member of the company, and no doubt the improvements will be entirely with European machinery.

In La Guaira the electric-light plant is under the direction of Carlos Pacanins and supplies eighty-eight arc and 564 incandescent lamps of sixteen candlepower. The charge here is seventy bolivars ($13.51) monthly for 1,200-candlepower arcs and five bolivars (96.5 cents) monthly for a sixteen-candlepower lamp ten hours or 500 kilowatt-hours. For power current the charge is ten cents for each 1,000 watts. The general expenses of this plant amount to $1,115 monthly.

The pay of laborers at La Guaira is about the same as at the Caracas plants, and ranges from eighty cents per day for common laborers to $60 per month for engineers and dynamo men.

The above information was furnished by Consul Isaac A. Manning, of La Guaira, in a recent report, and was prepared with the assistance of Acting Consular Agent Heny.

Reducing Smoke in Glasgow.

An interesting device for consuming smoke is being marketed in Great Britain. The following description and account of a test are abstracted from a recent issue of the *Engineer and Iron Trades Advertiser*, of Glasgow, Scot.:

The device consists practically of an extra grate composed of perforated asbestos and fireclay blocks. This is built behind the ordinary grate, and is proportioned so as to give an intense temperature to the air required for perfect combustion. The smoke and unconsumed gases passing from the firegrate are retarded by the extra grate, and igniting give flame instead of passing into the boiler flues as a mixture of smoke and unconsumed gases. No holes and no steam jets are made in the boiler. The apparatus works automatically, and can be turned on or off by moving a lever below the door of the furnace. The makers claim that this apparatus, besides preventing smoke, reduces the cost of steam production by effecting economy in coal consumption. They also state that it is thoroughly durable, and that the cost of repair is practically nil.

The effectiveness of the system was demonstrated at a recent test in a Glasgow oil and paint mill. The fire was coaled with ordinary furnace fuel, and it was allowed to burn for a few minutes without the coal-consuming apparatus being in operation. Black smoke issued from the chimney in copious quantities. Then the apparatus was applied, and within forty seconds—the time required to allow the flues to clear—not the slightest semblance of smoke was to be seen at the mouth of the chimney. The smoke consumer can be fitted to almost any boiler.

Operating Cost of Small Producer Plant.

One of the queries proposed in the "Question Box" of the Bulletin of the National Electric Light Association, "What is a fair average operating cost per kilowatt-hour for a gas-producer plant of seventy-five kilowatts capacity," is answered by Aldis E. Hibner, of Rochester, N. Y., in the January, 1910 (Vol. III, No. 6), issue of the *Bulletin*, as follows:

Assuming that the gas-producer plant is for a factory working ten hours a day with a load factor of sixty per cent, or a six hours' use of the maximum demand, the following would be a fair operating cost, not including breakdown service, superintendence, night lighting, and a profit on the investment:

Investment for engine, producer and generator		$10,000.00
Fixed Cost.		
Interest, depreciation, insurance and taxes, 15 per cent		1,500.00
Operating Cost—140,000 Kilowatt-hours per Year.		
Coal at $2 per horsepower-hour, 187 tons at $4.50	$842.00	
Engineer's wages, at $18.00 per week	936.00	
Water, eight gallons per horsepower hour, at fourteen cents per 1,000	210.00	
Oil, waste and repairs	400.00	
		$ 2,388.00
		$ 3,888.00
Net cost per kilowatt-hour—$3,888.00/140,000		$0.0278

TELEPHONY—TELEGRAPHY, and WIRELESS.

WIRELESS TELEGRAPHY.[1]

BY WILLIAM MARCONI.

The application of electric waves to the purposes of wireless telegraphic communication between distant parts of the earth, and the experiments which I have been fortunate enough to be able to carry out on a larger scale than is obtainable in ordinary laboratories, have made it possible to investigate phenomena and note results often novel and unexpected. In my opinion, many facts connected with the transmission of electric waves over great distances still await a satisfactory explanation, and I hope to be able in this lecture to refer to some observations which appear to require the attention of physicists.

The main feature in my system consisted in the use of elevated capacity areas or vertical wires attached to one pole of the high-frequency oscillators and receivers, the other pole of which was earthed.

Many technical writers have stated that an elevated capacity at the top of the vertical wire is unneeessary. This is true if the length or height of the wire is made sufficiently great, but as this height may be much smaller for a given distance if a capacity area is used, it is more economical to use such capacities, which now usually consist of a number of wires spreading out from the top of the vertical conductor.

The necessity or utility of the earth connection has been sometimes questioned, but in my opinion no practical system of wireless telegraphy exists where the instruments are not connected to earth. By "connecting to earth" I do not necessarily mean an ordinary metallic connection as used for ordinary wire telegraphs. The earth wire may have a condenser in series with it, or it may be connected to what is really equivalent, a capacity area placed close to the surface of the ground.

It is now perfectly well-known that a condenser, if large enough does not prevent the passage of high-frequency oscillations, and therefore in these cases the earth is for all practical purposes connected to the antennas.

After numerous tests and demonstrations in Italy and in England over distances varying up to forty miles, communication was established for the first time across the English Channel between England and France in March, 1899. From the beginning of 1898 I had practically abandoned the early system of connection, and instead of joining the coherer or detector directly to the aerial and earth, I connected it between the ends of the secondary of a suitable oscillation transformer containing a condenser and tuned to the period of the electrical waves received. The primary of this oscillation transformer was connected to the elevated wire and to earth. This arrangement allowed of a certain degree of syntony, as by varying the period of oscillation of the transmitting antennas, it was possible to send messages to a tuned receiver without interfering with others differently syntonized.

As it is now well known, a transmitter consisting of a vertical wire discharging through a spark-gap is not a persistent oscillator, the radiation it produces is strongly damped. Its electrical capacity is comparatively so small and its capability of radiating energy so large that its oscillations decrease or die off with great rapidity. In this case receivers or resonators of a considerably different period or pitch are likely to be affected by it.

Early in 1899 I was able to improve the resonance effects obtainable by increasing the capacity of the elevated wires by placing adjacently to them earthed conductors, and inserting in series with the aerials suitable inductance coils.

By these means the energy storing capacity of the aerial was increased, whilst its capability to radiate was decreased, with the result that the energy set in motion by the discharge formed a train of succession of feebly damped oscillations. By a modification of this arrangement, excellent results were obtained.

In 1900 I constructed and patented transmitters which consisted of the usual kind of elevated capacity area and earth connection, but these were inductively coupled to an oscillation circuit containing a condenser, an inductance, and a spark gap, the condition which I found essential for efficiency being that the periods of electrical oscillation of the elevated wire or conductor should be in time or resonance with that of the condenser circuit. The circuits consisting of the oscillating circuit and radiating circuit, were more or less closely "coupled" by varying the distance between them. By the adjustment of the inductance inserted in the elevated conductor and by the variation of the capacity of the condenser circuit, the two circuits were brought into resonance, a condition which, as I have said, I found essential in order to obtain efficient radiation.

It seems well established that wireless telegraphy, as practiced at the present day, is dependent for its operation over long distances on the conductivity of the earth, and that the difference in conductivity between the surface of the sea and land is sufficient to explain the increased distance obtainable with the same amount of energy in communicating over sea as compared to over land.

The belief that the curvature of the earth would not stop the propagation of the waves, and the success obtained by syntonic methods in preventing mutual interference, led me in 1900 to decide to attempt the experiment of testing whether or not it would be possible to detect electric waves over a distance of 4,000 kilometres, which, if suc-

[1] Abstract of Marconi's Nobel Prize Lecture, delivered December 11.

cessful, would immediately prove the possibility of telegraphing without wires between Europe and America.

The experiment was, in my opinion, of great importance from a scientific point of view, and I was convinced that the discovery of the possibility to transmit electric waves across the Atlantic Ocean, and the exact knowledge of the real conditions under which telegraphy over such distances could be carried out, would do much to improve our understanding of the phenomena connected with wireless transmission. The transmitter erected at Poldhu, on the coast of Cornwall, was similar in principle to the one I have already referred to, but on a very much larger scale than anything previously attempted. The power of the generating plant was about twenty-five kilowatts.

My previous tests had convinced me that when endeavoring to extend the distance of communication, it was not merely sufficient to augment the power of the electrical energy of the sender, but that it was also necessary to increase the area or height of the transmitting and receiving elevated conductors.

As it would have been too expensive to employ vertical wires of great height, I decided to increase their number and capacity, which seemed likely to make possible the efficient utilization of large amounts of energy.

The arrangement of transmitting antennas, which was used at Poldhu, consisted of a fanlike arrangement of wires supported by an insulated stay between masts only forty-eight metres high and sixty metres apart. These wires converged together at the lower end, and were connected to the transmitting apparatus contained in a building. For the purpose of the test a powerful station had been erected at Cape Cod, near New York, but the completion of the arrangements at that station was delayed in consequence of a storm which destroyed the masts and antennas.

I, therefore, decided to try the experiments by means of a temporary receiving station erected in Newfoundland, to which country I proceeded with two assistants about the end of November, 1901.

The tests were commenced early in December, 1901, and on the 12th of that month the signals transmitted from England were clearly and distinctly received at the temporary station at St. John's in Newfoundland.

Confirmatory tests were carried out in February, 1902, between Poldhu and a receiving station on the *Philadelphia*, of the American Line. On board this ship readable messages were received by means of a recording instrument up to a distanc of 1,551 miles, and test letters as far as 2,099 miles from Poldhu. The tape records obtained on the *Philadelphia* at the various distances were exceedingly clear and distinct.

A result of scientific interest which I first noticed during the tests on the *Philadelphia*, and which is a most important factor in long-distance radiotelegraphy, was the very marked and detrimental effect of daylight on the propagation of electric waves at great distances; the range by night being usually more than double that attainable during daytime.

I do not think that this effect has yet been satisfactorily investigated or explained. At the time I carried out the tests I was of opinion that it might be due to the loss of energy at the transmitter, caused by the dis-electrification of the highly-charged transmitting elevated conductor under the influence of sunlight.

I am now inclined to believe that the absorption of electric waves during the daytime is due to the ionization of the gaseous molecules of the air affected by ultra-violet light, and as the ultra-violet rays, which emanate from the sun, are largely absorbed in the upper atmosphere of the earth, it is probable that the portion of the earth's atmosphere which is facing the sun will contain more ions or electrons than that portion which is in darkness, and, therefore, as Sir J. J. Thomson has shown, this illuminated and ionized air will absorb some of the energy of the electric waves.

Apparently the length of wave and amplitude of the electrical oscillations have much to do with this interesting phenomenon, long waves and small amplitudes being subject to the effect of daylight to a much lesser degree than short waves and large amplitudes.

According to Professor Fleming, the daylight effect should be more marked on long waves, but this has not been my experience. Indeed, in some very recent experiments in which waves about 8,000 metres long were used, the energy received by day was usually greater than at night.

The fact remains, however, that for comparatively short waves, such as are used for ship communication, clear sunlight and blue skies, though transparent to light, act as a kind of fog to these waves. Hence the weather conditions prevailing in England are usually suitable for wireless telegraphy.

During the year 1902 I carried out some further tests between the station at Poldhu and a receiving installation erected on the Italian cruiser *Carlo Alberto*, kindly placed at my disposal by the King of Italy. During these experiments the interesting fact was observed that, even when using waves as short as 1,000 feet, intervening ranges of mountains, such as the Alps or Pyrenees, did not, during the night time, bring about any considerable reduction in the distance over which it was possible to communicate. During daytime, unless much longer waves and more power were used, intervening mountains greatly reduced the apparent range of the transmitter. Messages and press despatches of considerable length were received from Poldhu.

With the active encouragement and financial assistance of the Canadian Government, a high-power station was constructed at Glace Bay, Nova Scotia, in order that I should be able to continue my long-distance tests, with a view to establishing radiotelegraphic communication on a commercial basis between England and America.

On December 16, 1902, the first official messages were exchanged at night across the Atlantic, between stations at Poldhu and Glace Bay.

Further tests were shortly afterwards carried out with another long-distance station at Cape Cod, in the United States of America; and under favorable circumstances it was found possible to transmit messages to Poldhu, 3,000 miles away, with an expenditure of electrical energy of only about ten kilowatts.

In the spring of 1903 the transmission of press messages by radiotelegraphy from America to Europe was attempted, and for a time the London *Times* published, during the latter part of March and the early part of April of that year, news messages from its New York correspondent, sent across the Atlantic without the aid of cables. A breakdown in the insulation of the apparatus at Glace Bay made it necessary, however, to suspend the service, and, unfortunately, further accidents

made the transmission of messages uncertain and unreliable.

As a result of the data and experience gained by these and other tests, which I carried out for the British Government, between England and Gibraltar, I was able to erect a new station at Clifden in Ireland, and enlarge the one at Glace Bay in Canada, so as to enable me to initiate, in October, 1907, communication for commercial purposes across the Atlantic between England and Canada.

Although the stations at Clifden and Glace Bay had to be put into operation before they were altogether complete, nevertheless communication across the Atlantic by radiotelegraphy never suffered any serious interruption during nearly two years, until, in consequence of a fire at Glace Bay this autumn, it has had to be suspended for three or four months.

This suspension has not, however, been altogether an unmitigated evil, as it has given me the opportunity of installing more efficient and up-to-date machinery. The aerial used consisted of a nearly vertical portion in the middle, 220 feet high, supported by four towers, and attached at the top to nearly horizontal wires, 200 in number and each 1,000 long, extending radially all round, and supported at a height of 180 feet from the ground by an inner circle of eight, and an outer circle of sixteen, masts. The natural period of oscillation of this aerial system gave a wave-length of 12,000 feet. Experiments were made with this arrangemet in 1905; and with a wavelength of 12,000 feet, signals, although very weak, could be received across the Atlantic by day as well as by night.

The system of aerial I finally adopted for the long-distance station in England and Canada not only makes it possible to efficiently radiate and receive waves of any desired length, but it also tends to confine the main portion of the radiation to a given direction. The limitation of transmission to one direction is not very sharply defined, but the results obtained with this type of aerial are nevertheless exceedingly useful.

Many suggestions respecting methods for limiting the direction of radiation have been made by various workers, notably by Professor F. Braun, Professor Artom, and Messrs. Bellini and Tosi.

In a paper read before the Royal Society in London in March, 1906, I showed how it was possible by means of horizontal aerials to confine the emitted radiations mainly to the direction of their vertical plane, pointing away from their earthed end. In a similar manner it is possible to locate the bearing or direction of a sending station. The transmitting circuits at the long-distance stations are arranged in accordance with a comparatively recent system for producing continuous or slightly damped oscillations, which I referred to in a lecture before the Royal Institution of Great Britain on March 13, 1908.

With regard to the receivers employed, important changes have taken place. By far the larger portion of electric wave telegraphy was, until a few years ago, conducted by means of some form or other of coherer, or variable contact either requiring tapping or else self-restoring.

At the present day, however, I may say that at all the stations controlled by my company, my magnetic receiver is almost exclusively employed. This receiver is based on the decrease of magnetic hysteresis, which occurs in iron when under certain conditions this metal is subjected to the effects of electrical waves of high frequency. It has recently been found possible to increase the sensitiveness of these receivers, and to employ them in connection with a high speed relay, so as to record messages at great speed.

A remarkable fact, not generally known, in regard to transmitters is, that none of the arrangements employing condensers exceed in efficiency the plain, elevated aerial or vertical wire discharging to earth through a spark gap, as used in my first experiments.

I have recently been able to confirm the statement made by Professor Fleming in his book, "The Principles of Electric Wave Telegraphy" (1906, page 555), that with a power of eight watts in the aerial it is possible to communicate to distances of over 100 miles.

I have also found that by this method it is possible to send signals 2,000 miles across the Atlantic, with a smaller expenditure of energy than by any other method known to myself.

The only drawback to this arrangement is, that unless very large aerials are used, the amount of energy which can be efficiency employed is limited by the potential beyond which brush discharges and the resistances of the spark gap begin to have a deleterious effect.

By means of spark gaps in compressed air, and the addition of inductance coils placed between the aerial and earth, the system can be made to radiate very pure and slightly damped waves, eminently suitable for sharp tuning.

In regard to the general working of wireless telegraphy, the widespread application of the system and the multiplicity of the stations have greatly facilitated the observation of facts not easily explainable.

Thus it has been observed that an ordinary ship station utilizing about half a kilowatt of electrical energy, the normal range of which is not greater than 200 miles, will occasionally transmit messages across a distance of over 1,200 miles. It often occurs that a ship fails to communicate with a nearby station, but can correspond with perfect ease with a distant one.

Although high-power stations are now used for communicating across the Atlantic, and messages can be sent by day as well as by night, there still exist short periods of daily occurrence, during which transmission from England to America, or vice versa, is difficult. Thus in the morning and evening, when in consequence of the difference in longitude, daylight or darkness extends only part of the way across the ocean, the received signals are weak and sometimes cease altogether. It would almost appear as if electric waves in passing from dark space to illuminated space, and vice versa, were reflected in such a manner as to be diverted from their normal path.

It is probable that these difficulties would not be experienced in telegraphing over equal distances north and south, on about the same meridian, as in this case the passage from daylight to darkness would occur almost simultaneously over the whole distance between the two points.

Another curious result, on which hundreds of observations continued for years leave no further doubt, is that regularly, for short periods, at sunrise and sunset, and occasionally at other times, a shorter wave can be detected across the Atlantic in preference to the longer wave normally employed.

Thus at Clifden and Glace Bay, when sending on an ordinary coupled circuit

arranged so as to simultaneously radiate two waves, one 12,500 feet and the other 14,700 feet, although the longer wave is the one usually received at the other side of the ocean, regularly, about three hours after sunset at Clifden, and three hours before sunrise at Glace Bay, the shorter wave alone was received with remarkable strength, for a period of about one hour. This effect occurred so regularly that the operators tuned their receivers to the shorter wave at the times mentioned, as a matter of ordinary routine.

Wireless Telegraphy and Weather Forecasts.

An experiment in obtaining wireless telegrams from ocean steamers for use in weather forecasts, which was undertaken jointly by the German Naval Observatory in Hamburg and the Meteorological Institute in London, has been concluded. Of the German steamship companies the Hamburg-American Line and the North-German Lloyd participated in the experiment, and the Marconi Company transmitted the telegrams for a fixed monthly compensation. In the tests carried out during August and September no attempt was made to obtain observations from beyond the thirtieth degree of longitude west of Greenwich, as the timely receipt of telegrams from such great distances could not be expected. Reports were sent by twenty-three German steamers on seventy-four trips with 276 telegrams, and by forty-nine English steamers on 181 trips with 568 telegrams. The vessels transmitted each time two numbers of five ciphers each, which represented the position of the ship, time and hour of observation, barometer reading, direction and strength of the wind. The usefulness of telegrams for weather forecasts depends essentially on the time of their receipt. Nearly seventy-five per cent of the evening observations made up to the thirteenth degree of western longitude reached Hamburg within two and one-half hours, but of the morning observations there arrived less than fifty per cent, and of those made beyond the thirteenth degree less than ten per cent. The experiments were therefore unsatisfactory, as the morning telegrams could be of no appreciable influence on the weather forecasts. The evening observations might be utilized to advantage, but the costs are too high in proportion to the benefit to be derived from them. The question can be considered only when the transmitting distance of wireless installations on vessels has been considerably increased. —*Translated and abstracted from Elektrolechnische Zeitschift (Berlin), December 16.*

A British-Norwegian Cable.

Consul-General Henry Bordewich, of Christiana, sends the following advices, printed in a recent Consular Report, concerning cable connections between Great Britain and Norway.

Director Heftye, of the Norwegian state telegraph system, has been in London for some time arranging the details of an agreement between the British and the Norwegian Governments for the establishment of a new British-Norwegian telegraph cable between Peterhead in Scotland and Egersund, Norway. On February 2, 1905, the two Governments agreed that the franchise of the Great Northern Telegraph Company should not be renewed after January 1, 1911, without negotiations between the two Governments for the establishment of a new line. The original franchise was given in 1869 and renewed January 1, 1881, for thirty years.

The negotiations between the British telegraph authorities and the Norwegian Department of Public Works resulted in an agreement that the cable line between the two countries should in the future be carried on by themselves, the British administrative authorities making the necessary agreement with the telegraph company for the sale of the cable at its actual value. It is the intention to reduce the rate from six cents to four cents per word.

The Ruhmer System of Phototelegraphy.

Some particulars, contributed by the inventor himself, are given in a recent issue of *The Electrician*, of London, England, of a system of phototelegraphy devised by Herr Ruhmer. This system depends on the behavior of selenium under the action of light.

Herr Ruhmer uses screens, such as are employed in electrotypy, and is thus able to divide up the picture he wishes to transmit, into a number of sections. The apparatus employed consists essentially of a receiver, a sender, the connecting line, and a twelve-volt battery. By means of a projection apparatus the picture it is required to transmit is magnified and thrown on the transmitting screen. Each division on the screen is connected to a selenium cell which is illuminated or darkened according to the light and shade of that portion of the picture falling on the particular section of the screen. The corresponding sections of the receiving screen are thus more or less lighted by the current passing through a small glow-lamp. In this way a true picture is obtained at the receiving end.

Herr Ruhmer affirms that in spite of the fact that the apparatus he has been using is only a model, he has obtained some very satisfactory results, and that it is the first apparatus by which pictures have been transmitted in less than a second, as hitherto the inertia of selenium has rendered this impossible. He proposes to try the equipment on long lines to test the effect of capacity and self-induction on the results.

Telegraph, Telephone and Postal Service in Venezuela.

Consul Isaac A. Manning, of La Guaira, has made a detailed report concerning the telegraph and telephone service of Venezuela. At the beginning of 1909 there were 4,756 miles of telegraph lines in Venezuela, with 169 offices. Mr. Manning has also sent to the authorities at Washington, a newly published government map of the telegraph and telephone lines and the postal and railway system of Venezuela. A similar map has been received from Minister William W. Russel, at Caracas. These and the consul's report and telephone directories, it is announced in a recent Consular Report, will be loaned to interested business firms by the Bureau of Manufactures, Washington, D. C.

A Motor-Driven Plough.

A system of ploughing, in which a large plough making furrows 1.5 metres and 0.3 of a metre deep is propelled by a steel cable actuated by a motor-driven drum, was recently demonstrated in France before representatives of the Department of Agriculture, and will be employed shortly in Tunis, Africa, on a large scale of operation. Current for the motor is distributed by copper wires carried on movable posts.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

STREET LIGHTING FIXTURES—INCANDESCENT LAMPS.

BY GILBERT MULOCK.

From the various articles which have appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, it is apparent that our municipalities are awakening to the fact that America has been behind Europe in the matter of public lighting, but the manner of their awakening can only be received with mingled joy and regret.

Will it take another generation to bring matters to a point where we may say that our highways are the envy of the whole world, by night for their brilliancy and by day for their architectural adornments?

The public lighting question is in the minds of one or many persons in every city. Booster clubs consider it a *piece de resistance*. The mayor mentions it in his annual message. The local scribe sets forth its possibilities and the central station gets the business early or late, according to its aggressiveness.

In the days of the oil lamp and even later, when gas with its shimmering, feeble flame was used to light the public ways, the only posts or poles which were used in any number along the street were those for this purpose. The advent of electricity changed all of this and light, trolley, telegraph and telephone poles are all too numerous in many of our cities.

Even before the tungsten lamp came to bring both joy and some sorrow to the heart of the central-station manager, a number of cities had the wooden arc-lamp poles removed and in their stead erected ornamental iron posts equipped with incandescent lamps in opal or frosted glass globes. The removal of the wooden lighting pole was of course an improvement, but many more were left and the effect may be seen in Fig. 1.

In these days when watches may be had for a dollar and automobiles are almost given away (at least that's what the salesmen say), it seems absurd to place gigantic clocks and numberless hitching posts along the main street, as is illustrated in Fig. 2.

FIGS. 1 AND 2.—STREET SCENES IN A SOUTHERN CITY SHOWING A MULTIPLICITY OF POLES AND POSTS ALONG THE CURB LINES.

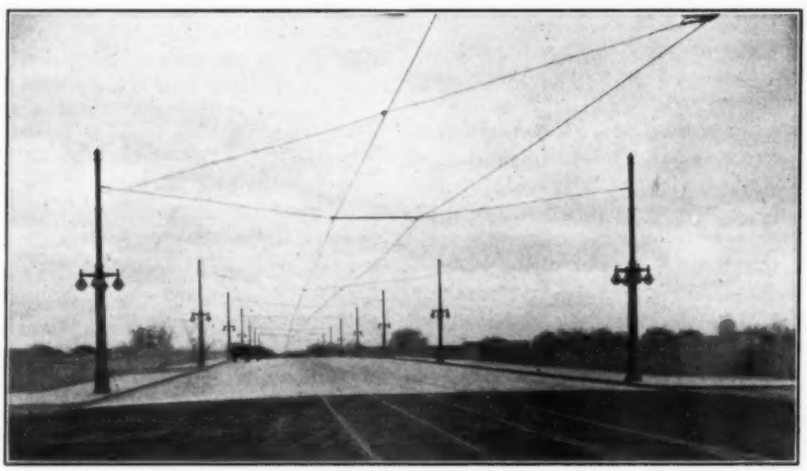


FIG. 3.—COMBINATION LIGHT AND TROLLEY POSTS.

Combination lighting and trolley poles have long been used abroad and strange as it would seem, our supposedly wideawake, hustling American

has turned a deaf ear to their value and importance. One of the few installations we have is shown in Fig. 3, and that every detail has been carried out most successfully is apparent. The

FIG. 4.—NEAR VIEW OF THE COMBINATION POST.

outer casting and the lighting equipment, shown in detail in Fig. 4, make it evident that a little time and money will work wonders.

One feature of the so-called ornamental installations of public lighting which is purely American is the method of having the local merchants pay the bill, and the result is that they rarely know what they want in the matter of fixtures and equipment until they see them in operation.

FIG. 5.—POST WITH BRACKET LAMPS UPRIGHT.

FIG. 6.—POST WITH BRACKET LAMPS PENDENT.

In some cases they desire the globes in a pendent position, as shown in Fig. 1, and in others they prefer them upright, as shown in Fig. 2. Realizing this, an enterprising manufacturer has recently designed a post upon which the lamps can be placed either upright or pendant as shown in Figs. 5 and 6.

While it may sound like sermonizing to state that attention to details is most important, the illustration herewith would seem to indicate that that certainly is the case in the matter of lamp-post design and installation.

A Successful English Experience with Tungsten Lamps.

In many sections of England the introduction of tungsten lamps was considered with much alarm because it was felt that the small margin of profit left the central station under existing conditions would be wiped out by the diminished current sales due to the high-efficiency lamps. In some localities the rates to users of metallic-filament lamps were raised. Among the towns that adopted more liberal policy toward the new lamps was Harrogate. Its experience with their introduction was narrated before the Trade Section of the Instituton of Electrical Engineers on December 15 last by G. Wilkinson and R. McCourt. Their paper was abstractd in *The Electrical Engineer* (London, December 17).

In the first place, the question as to whether the price per unit ought to be increased had to be faced, and it was felt that inasmuch as consumers are naturally chary of introducing new lamps before being fully assured of the reality of the claimed advantage, the anticipated large adoption of them was bound to be gradual, and it was therefore decided not to recommend an increase in the price, but rather to adopt a policy which would educate the public to appreciate the economy and possibilities of the new lamps.

It has always been regarded as an axiom in central station circles that good street lighting is one of the best advertisements that an electricity department can have, and by way of experiment a seventeen-ampere open-type alternating-current lamp which had been in use over twelve years was displaced by a four-arm fitting having four 100-candlepower metallic-filament lamps. The general public and the local press, without knowing anything of the saving in current, expressed themselves in no uncertain voice as being in favor of the incandescent lamps, largely because of the absence of the flickering and light variation so characteristic of the arc lamp. When it was further pointed out that not only was there a large saving in current consumed, but that the additional costs of arc lighting—viz., carbons, trimming, repairs and wages were not necessary in the case of the metallic lamps—instructions were given to convert the greater part of the arc lighting of the town to the newer form of illuminant.

It was decided to deal first with a stretch of roadway then lighted by twenty open-type series alternating-current arc lamps, and it was arranged that eighteen of these arc lamp-posts should be fitted each with two-arm fittings carrying two 100-candlepower 200-volt metallic-filament lamps, and the remaining two posts fitted with four-arm fittings carrying four similar lamps. Each arm is fitted with a thirteen-inch Holophane reflector, which, while giving a pleasing effect in the daytime, materially assists the effective illumination when the lamps are alight. In the case of a business street, it would not be sufficient simply to displace arc lamps by two 100-candlepower metallic-filament lamps, but, in addition, new intermediate posts having similar fittings, would have to be erected.

While the lighting authority was making these drastic alterations in street-lighting arrangements the pri-

vate consumers were not slow to take advantage of the opportunity afforded them by the metal lamps to reduce their lighting accounts. This effect was noticed first in the business part of the town, where the shops are chiefly supplied at 100 volts. The local contractors for a time found themselves unable to supply the demand for lamps. One good result accruing from the change was in getting a number of installations re-connected which had gone back to gas. The general effect on the supply station, however, from this class of consumer was not so apparent in the reduction of the number of units sold so much as in a generally increased illumination. However, as the average householder began to realize that by installing a small transformer to reduce the supply pressure to twenty-five or fifty volts, and also that metallic-filament lamps of sixteen and twenty-five candlepower at twenty-five volts were quite as stable and dependable as the old carbon-filament lamps, it was found by the monthly generation sheet that instead of, as formerly, having to record with unfailing regularity an increase in the number of units generated, as compared with the similar month in the previous year, the ominous word "decrease" was creeping in.

As an instance of the marvelous results which can be obtained by the use of metallic-filament lamps at low voltages, the following figures relating to a large hotel in Harrogate which adopted the method are of interest: In the year ending December, 1906, they used 13,712 units, while in the year ending December, 1908, they increased their illumination and used only 7,672 units. Notwithstanding the possibility of such a remarkable reduction in the number of units used by the larger consumers, and in spite of the fact that approximately 30,000 to 40,000 metal-filament lamps have been disposed of in Harrogate, the number of units sold for lighting purposes for the year ending March, 1909, are only five per cent below the figure for the year ending March, 1908, and the figures for units sold for all purposes are only down 2.5 per cent.

While it was gratifying to realize that the gloomy prophets who prognosticated that in a short time the output of the majority of electricity supply stations would be so reduced that it would be necessary to increase the price per unit were entirely at fault, it was felt that some steps ought to be taken to use the weapon science had placed in our hands to try to introduce electric lighting into the smaller houses and thus tap that source of revenue which the gas companies have found so remunerative, viz., the class of house which has seldom more than from two to six lamps alight at one time. This problem was complicated by the fact that in the past all the details in connection with services were arranged so as to be able to supply at least ten times the capacity of such small installations, and that, unless cheaper services can be installed, the revenue from such consumers would scarcely more than pay the interest on the capital costs.

It was realized that in dealing with small consumers it would be a great advantage to have no meters, and to charge them for their supply on a contract system. The great disadvantage to such a system, as proved by previous experience, was that unlimited use of the supply was apt to be taken unfair advantage of, and in view of that it was decided to offer a contract system of charging on the following terms:

I. Consumer must supply his own lamps.
II. Each apartment in which a lamp was installed must be adequately lighted by lamps in the daytime.
III. The maximum number of lamps to be alight at one time to be declared at the commencement of the contract.
IV. The minimum number of lamps applied for to be two and the maximum six, each taking thirty watts.
V. The charge to be sixty-six cents per quarter per thirty-watt lamp, payable in advance.

Clause I tends to counteract the temptation to use the light more than actually necessary because of the cost of renewals of these comparatively expensive lamps.

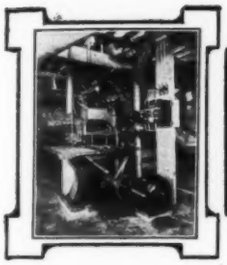
Clause III permits the installation of a current limiter which causes the lamps to flicker if more than the number contracted for are switched on.

The current limit indicator which has been adopted is of a simple thermal type, compensated for variation in atmospheric temperature. Its cost is less than half the price of a reliable meter.

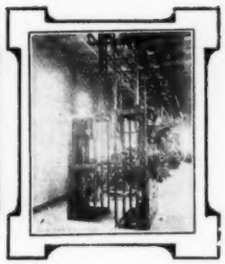
The advantages of the contract method of charging for a supply of electricity on these lines are so obvious that it seems scarcely necessary to enumerate them, but it is interesting to note that they are almost equally as attractive to consumer as to company. They are as follows:

1. Consumer knows exactly what the amount of his quarterly account will be. This is a strong point.
2. Consumer can have the use of the light in every apartment. This is a boon to him, particularly in the case of bedrooms, as it is found under the old order in the smaller houses the tendency is not to use electric light in these rooms.
3. The supply company is saved the cost of demand indicators, half the cost of the meters, and the continuous expense of repairs and recalibrations and the excitation current taken by the meters, also the cost of meter readings.
4. The bookkeeping is simplified, and the risk of incurring bad debts is banished, due to the payment being made in advance.

Reference has already been made to the very serious difficulty which had to be faced due to the fact that the requirements of these installations did not necessitate anything like the same expenditure on services as had been customary. For example, it was found that the average cost of service, and the accessories, including meters in Harrogate for the four years ending March, 1908, was nearly $35. The interest on this sum at ten per cent is $3.50 and if the service to a small house paying $5.35 per year for two lamps was to cost that sum, there would only be left $1.85 to pay for the current consumed. Under these circumstances it was necessary to consider in what direction a reduction could be made. First of all, in the mater of cable, the standard practice in services was to use concentric paper-insulated lead-covered and armored cable, costing about $800 per mile, and it was decided that a five-ampere cable would be of ample capacity to serve the smaller houses, costing $250 per mile. Then the cut-out box of twenty-five ampere size, costing $2.50 to $3.00, was displaced by a smaller box costing $1.00 each. Again, the current limiter only costs $3.75, as compared with the former price of $8.75 to $10.00 for a meter. Further, the cost of labor is reduced to one-half of what it formerly was, and it is conclusively poved that the cost of all these does not exceed $11.25 to $12.50.



Industrial Power



ELECTRICALLY DRIVEN PUMPS.—V.

TESTS OF INSTALLATION AT LOCKPORT, N. Y.

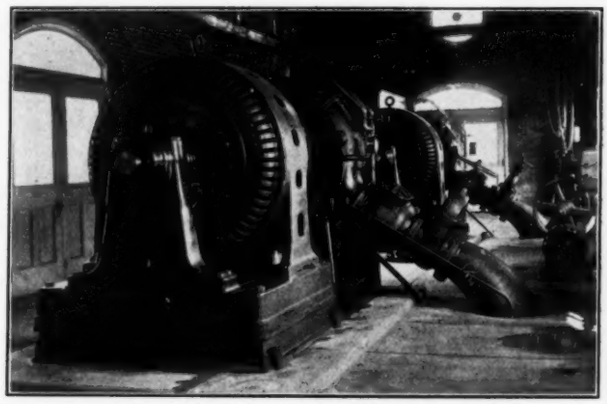
The city of Lockport, N. Y., derives its water supply from the Niagara River near North Tonawanda, thirteen miles away. From the electrically-driven pumping station at this point the water is forced through 69,000 feet of thirty-inch main to a standpipe thirty-five feet in diameter and 130 feet high, at Lockport.

The pumping plant contains three independent units with a combined capacity of delivering 15,000,000 gallons in twenty-four hours against a pressure of 125 pounds. Each unit comprises a Westinghouse induction motor, designed for 500 horsepower at 750 revolutions per minute, with three-phase current at 400 volts, direct-connected to a single-suction, inclosed-impeller centrifugal pump made by the Holly Manufacturing Company, Buffalo.

Power generated at Niagara Falls is transmitted to North Tonawanda at 22,000 volts and is stepped down to 440 volts at the pumping station by three 500-kilowatt, oil-insulated, water-cooled transformers.

INTERIOR VIEW OF THE PUMPING STATION AT LOCKPORT, N. Y.

THE PUMPING PLANT, SHOWING THE PUMPS.



THE PUMPING PLANT, SHOWING THE MOTORS.

The three motor-driven pumping units were recently given a very complete test, which developed some interesting economies of electric operation. Each unit was run continuously for fifteen hours, during which time readings of the electrical input were taken every five minutes; readings of the Venturi water meter every ten minutes; pressure gauge every five minutes, and revolutions of pump every fifteen minutes. The results are given in the accompanying table, which shows that all three of the pumps exceeded the duty requirement of 27,000,000 foot-pounds by approximately 4,000,000 foot-pounds. It will be further noted that the temperature rises are well within the specifications, and that the pump capacities and horsepowers are well exceeded.

In the case of the Lockport pumping station, electrical energy is purchased at $16.00 per horsepower-year. The cost of power for this station is thus

just about equal to that of steam operation under conditions assuming cross-compound pumping engines giving a duty of 130,000,000 foot-pounds per

RESULTS OF TESTS OF LOCKPORT'S MOTOR DRIVEN PUMPING UNITS.

	Pump 1.	Pump 2.	Pump 3.
Maximum revolutions per minute	746	752	744
Minimum revolutions per minute	738	738	739
Average revolutions per minute	743	744	744
Maximum gauge pressure, pounds	142.5	144.5	143.5
Minimum gauge pressure, pounds	119.5	139.5	134.5
Average gauge pressure, pounds	136.5	142.6	138.9
Average head, feet	315.8	329.1	320.6
Gallons pumped per hour	238,000	236,300	236,700
Gallons pumped in twenty-four hours at this rate	5,712,000	5,672,000	5,712,000
Kilowatt input per hour	342.4	346.1	341.5
Gallons per kilowatt-hour	1,454	1,464	1,443
Hydraulic horsepower	318	327	319.5
Electric horsepower	456.6	456	455
Efficiency per cent	69.6	71	70
Duty, foot-pounds per 1000 kilowatts	30,800,000	31,600,000	31,000,000
Degrees temperature rise in fifteen hours	41	38	43

1,000 pounds of steam; coal at $3.00 per ton delivered into the boiler room; eight and one-half pounds evaporation under working conditions; and including labor for making steam and handling ashes, as well as increased fixed charges against the additional plant for operating with steam. This electrically-driven pumping plant is thus developing duty equal to 130,000,000 foot-pounds per 1,000 pounds of steam.

In connection with this plant which is pumping its output about thirteen miles to Lockport, it may be of interest to note that last summer when a large fire broke out there, eleven powerful fire streams through varying lengths of hose were maintained from the standpipe and pumps as long as needed for service.

The entire water supply of which this station forms a part, as well as the station itself, were designed by Charles A. Hague, of New York city.

(To be continued.)

Electrically Operated Collieries in Great Britain.

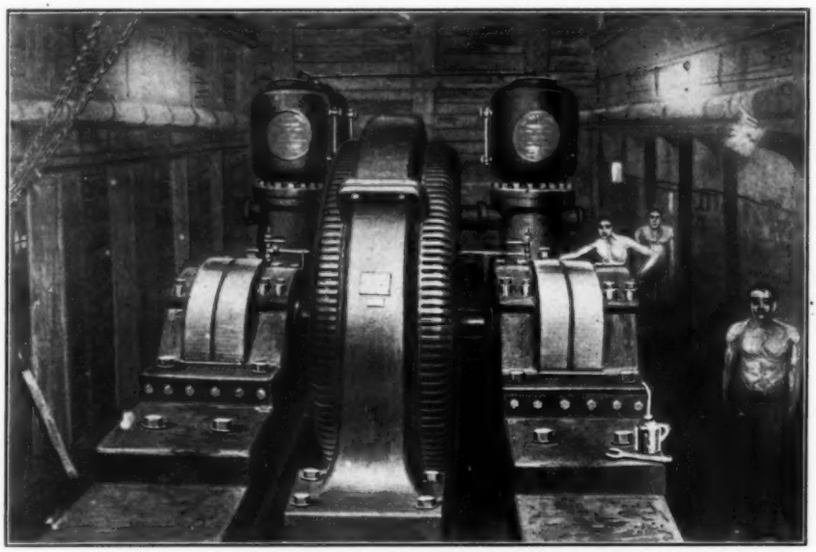
In the course of an article on "Mining Machinery" in a recent issue of the *Glasgow Herald*, Glasgow, Scot., Wilfred L. Spence called attention to the fact that there are in Great Britain several coal mines in which each and every power-consuming operation is performed solely by electricity. Mr. Spence said also that the number of these steamless collieries, supplied with electric energy from a centralized power station, or from public supply mains, is certain to grow rapidly in the near future.

State-Aided Canals.

"An inch of railway electrification is worth a mile of canals," says the London (England) *Electrical Times* in a recent editorial deprecating state-aided canals in England. Our contemporary points out that canals are inefficient as compared with railroads, at least in a country like England, and that in most cases they can exist only by cutting rates, with a consequent depreciation in the value of railroad property and investments.

An Electric Mine Pump.

The accompanying illustration is from a photograph taken in the Ward mine at Virginia City, Nev., the electric pumping installation of which was described in the January 15 issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.



PUMP HOUSE IN THE 3,100-FOOT LEVEL OF THE WARD MINE.

This illustration of the present permanent pump house, which is situated in the 3,100 level, was retouched from an actual flashlight photograph obtained during a recent visit to the mine. The temperature of the water pumped is 175 degrees Fahrenheit, and that of the pump house is normally about 110 degrees, a fact which accounts for the scanty attire of the men shown in the picture, who work their daily shifts of twelve hours under these conditions.

Electric Pumping Estimated to Reduce Expenses in Marquette, Mich.

A report from Marquette, Mich., states that the city water board has arranged for estimates on the cost of installing electric pumps, as well as on the extension of the intake and the removal of the plant to Presque Isle. All these estimates have been contracted for with the Duluth Engineering Company, and will be furnished as soon as certain surveys now being made are completed.

A citizen who has made a somewhat thorough investigation of the success of electric pumps stated recently that the water board could save the cost of the coal consumed, amounting last year to $5,288.50, by discontinuing the use of steam pumps and installing electric pumps in their stead. This is exactly what was done in Duluth several years ago and his opinion is largely based on the results of the experiment in that city. The steam plant is still maintained for use in case of emergency, but all the water is pumped by electricity, and the result has been a big reduction in pumping costs.

The capacity of the city electric lighting plant is sufficient to furnish power for the operation of the water works plant, and would utilize power that is now going to waste and probably will continue to be wasted, unless made use of in that manner. For about three hours in the late afternoon and early evening, during most of the year, the electric plant is so heavily loaded that the water-works pumps could not be operated, but this difficulty could be

overcome by constructing a reservoir in which water could be stored to tide the city over these three hours, and also over any emergency that might necessitate the shutting down of the electric light plant for a short time. The estimates to be furnished by the Duluth Enginering Company will include such a reservoir.

This calls to mind that in June, 1905, an electrical engineer in the employ of the Lake Shore Engine Works summitted a detailed report on electric pumps for the water works, at the close of which he recommended and advised their installation, and to which the water board at that time turned a deaf ear. Since that time the use of electric pumps in mines, cities and everywhere water is to be raised has become much more general, and from everywhere they have been installed has come entirely satisfactory reports.

In the above-mentioned report of 1905, the engineer referred to estimated that electric pumping would save nearly $4,000 a year for the next ten years, and that the light and power commission would derive an income of $2,753 a year for power sold at a period of the day when there is little demand for it.

Five years have elapsed since this report was made and the predictions made by the engineer have come true to a remarkable degree. At the present time, electric pumps seem to be by far the most economical system of raising large quantities of water, and it is reasonably certain that the report of the Duluth Engineering Company will be even more strongly in favor of the replacement of steam by electricity than that submitted to the board by the Lake Shore Engine Works five years ago.

The Melville-Macalpine Reduction Gear.

In a recent review of modern tendencies in electric work, H. M. Hobart, the well-known British Engineer, writing in the London (England) *Electrical Times*, says of the Melville-Macalpine reduction gear: "If further information bears out the claims which are now made for this gear, the suggestion should be obvious that apparatus of this type could appropriately be employed in driving a continuous-electricity generator of say 2,000 kilowatts capacity and 400 revolutions per minute, from a 1,500-revolutions-per-minute steam-turbine, thus obtaining the better steam economy of a 1,500-revolutions-per-minute steam-turbine and the far more satisfactory design of a 400-revolutions-per-minute continuous-electricity generator."

Electric-Furnace Developments.

Negotiations now under way may result in the licensing of several additional installations of the Héroult electric steel-making furnaces in this country, says *The Iron Trade Review*. At present there are only three American licensees, the Halcomb Steel Company, Syracuse, N. Y.; the Firth-Sterling Steel Company, McKeesport, Pa., and the United States Steel Corporation.

In Europe and Great Britain, the process has made considerable advance during the year. R. H. Wolff, 445 Broadway, New York, who is the American representative for the Héroult interests, states that three or four licenses have been granted to English steel-makers; heretofore the firm of Edgar Allen and Company, Sheffield, has been the only English licensee. The number of licenses on the Continent has been increased by about a half-dozen concerns of late.

Effect of Vulcanized Rubber on Copper.

The effect of the sulphur in vulcanized rubber on the copper of an electric cable is discussed by Ira W. Henry in a recent issue of *The India Rubber World*, as follows:

The vulcanizing process, which of necessity calls for the use of sulphur, naturally has a deleterious effect on the copper conductor. Many plans have been suggested and are in use whereby pure rubber or unvulcanized mixtures are placed next to the conductor, the vulcanized protection being a second layer surrounding the first. Even under these conditions the sulphur has been known to attack the conductor. An English chemist finding that bromine, idoine, and chlorine, instead of oxidizing indiarubber in contact with water, produced an altogether different effect, endeavored to turn this to account in the manufacture of cable core. By his process the conductor was covered with two coatings of indiarubber which were first made to adhere in boiling water and afterwards run through a solution of iodine. The rubber treated in this manner was said to withstand a considerable amount of heat without deteriorating. It also resists the action of air and that of ordinary solvents.

This method of applying insulation containing no sulphur does not attack the copper and has therefore been recommended for special work. The compound is said to retain a permanent elongation like copper when subjected to tension, so that the conductor would keep central when the strain on the core is released. The elastic qualities of indiarubber are also improved by the above treatment.

Owing to the enormous variations in the nature of vulcanized indiarubber as manufactured by various mixings and methods of treatment, it is difficult to give any definite physical, mechanical or electrical data for actual tests, but by specifying certain amounts of thoroughly dried high grade gums, specifications can be drawn of sufficient accuracy to meet the electrical conditions desired.

New York State Barge Canal Water Powers.

Calling attention to the fact that valuable water power in New York state is going to waste, Frank M. Williams, state engineer, in his annual report to the Legislature recommends an amendment to the law which prohibits the state from disposing of any water power created by barge-canal construction.

"While the intent of the law is good," says the report, "there are times when it results in positive loss to the state. If it were possible to exchange new for old power development in places where existing power is destroyed and new power developed on the same site, or to offset damages by grants of power in some form, numerous transactions of advantage to the state might be effected.

"At two sites, Vischer's Ferry and Crescent, there will soon be power possibilities from surplus waters amounting to 6,000 horsepower at each place that will go to waste for several years, if none of the power can be disposed of till the whole canal is completed. The same condition will exist at several other points where smaller powers have been or will be developed.

"It seems wise that the Legislature should give the Canal Board, or other responsible body, discretionary powers in such matters, authorizing them to lease water power on such terms, carefully safeguarding the navigation interests of the state, as may be prescribed by the Legislature."

QUESTIONS and ANSWERS

TUNGSTEN SERIES STREET LIGHTING.—I would like to replace my carbon-filament, thirty-two candlepower street lamps which are wired in multiples on 110-volt circuits, with low-voltage series tungsten lamps designed for 11.4 volts and 3 to 3.8 amperes. I will put ten of these lamps on the 110-volt circuit and twenty on the 220-volt circuit and wish to use a reactance coil in shunt with each socket to take care of the circuit if any of the lamps burn out. Can I operate the lamps successfully in this manner? Will it be necessary to use different types of reactance coils for these two different circuits, or will the same type suffice?—C. A. T., Mercur, Utah.

The plan proposed is entirely feasible provided the circuits are alternating-current circuits. Reactance coils cannot be used with direct current. One of the large electrical manufacturers has developed a system suitable for this purpose. It is called the "adjuster socket system" and provides a reactance coil in shunt across the terminal of each lamp which maintains the continuity of the circuit in case that particular lamp burns out. This reactance coil takes a small current during the normal operation of the lamp, but it does away with the need of having a series regulator in the circuit. The voltage that will be impressed upon each of the lamps will be a trifle below eleven volts so that the lamps will not develop their full rated thirty-two candlepower.

POWER FACTOR.—What is a power factor? How may it be found? What is the power factor for 1,100 volts, 2,300 volts, 6,600 volts? What is the effect of low power factor on a heavily loaded circuit?—R. R. C., St. Louis, Mo.

The power factor is a fraction by which the product of the volts and amperes of an alternating-current circuit must be multiplied in order to get the true power expressed in watts. The former product is frequently designated as the apparent power, but is not the true power, as the corresponding product of volts and amperes is with direct-current circuits. The power factor may be found by means of an instrument called a power factor indicator properly connected in the circuit; also by ascertaining the true power consumed in the circuit by means of a wattmeter and the volts and amperes used in the circuit by means of a voltmeter and ammeter; then dividing the wattmeter reading expressed in watts by the product of voltmeter and ammeter readings gives the power factor. The power factor does not depend upon the voltage of the circuit, and therefore there is no definite power factor for a 1,100-volt circuit, nor for any other. The power factor depends upon the character of the load; that is, whether it is inductive or condensive. Induction motors, arc lamps, or condensers in a circuit reduce its power factor. If the power factor on a heavily loaded circuit is low, it means that a very large current is flowing in that circuit without developing a correspondingly large amount of actual power.

THERMOSTATS.—I would like to get or make a thermostat that will operate an alarm, if the temperature falls below 105 degrees, and also operate another alarm if the temperature rises above 110 degrees. Will it be necessary to have two thermostats?—B. E. M., Seattle, Wash.

It is not necessary to use two thermostats for this purpose, as a single one can be readily arranged to operate both the low and the high alarms. Probably the simplest arrangement would be to secure a round dial thermometer and to have two platinum contacts arranged at the proper points so that the index can make contact with them. These two points should be in separate alarm circuits connected to a common battery. The shaft on which the index is mounted should be connected to the other terminal of this battery. Another form of thermostat can be arranged with an ordinary mercury thermometer having a long stem. Into the stem two platinum contact points must be inserted at the points desired. Another point is inserted in the bulb of the thermometer. The high point can be connected directly to an alarm and battery, whose other terminal is connected with the bulb. The low point must be connected through a relay in a similar manner. The relay is so arranged that if the mercury falls below the low point the relay circuit is broken, thus establishing the circuit of another alarm. It is not very easy, however, to insert contacts in a glass tube unless it is done by one skilled in the glass-blowing art. Thermostats of the order desired can be secured from a number of makers and will at least be more neat, if not more reliable, than those home-made.

SYNCHRONOUS MOTOR WITH DISCONNECTED FIELD COIL.—What will be the result if a synchronous motor, say of twelve poles, and running under full load, had one of its field coils disconnected? What would be the result if two opposite field coils were disconnected under the same conditions.—J. M. W., Portsmouth, Va.

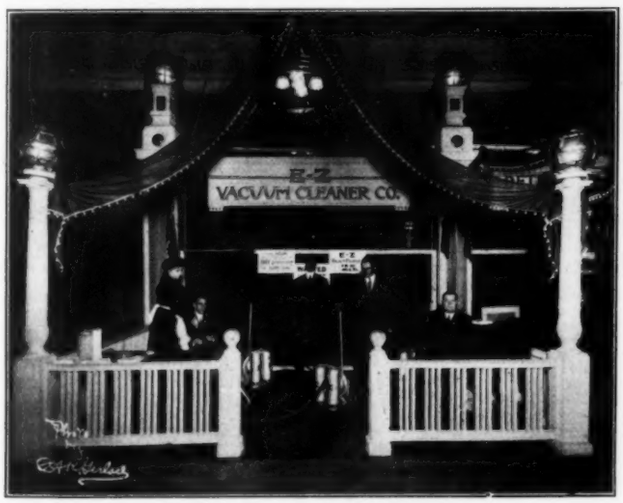
It is assumed in this case that one coil is disconnected or short-circuited without affecting the continuity or value of the current in the other coils which are in series with it. Under these conditions the motor will continue to run, but it will operate similarly to one with its field coils properly connected but not sufficiently excited. The power factor of the energy supplied to a synchoronous motor may be varied over a wide range by changing the value of the exciting current of the motor. By adjustment of this field current the voltage and line current can be brought in phase, giving a unity power factor. If the field excitation is weak the line current lags. If the field is strengthened the line current leads the line electromotive force. The operation of such a motor is more stable when the field excitation is high, since a leading armature current has a magnetizing action relative to its action on the field current, while a lagging current has a demagnetizing action. There is also less "hunting" under the former condition. Since the loss of one field coil results in a weakening of the resultant field strength it may be partially compensated by over-exciting the other coils. If two opposite field coils were disconnected without disturbing or changing the current in the other coils, then the field would be weakened more than if but one coil is disconnected and the power factor further reduced.

Chicago Electrical Show.

In the issues of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for January 22 and 29 there appeared a comprehensive resume of the principal features of the decorations and the exhibitions, together with those in attendance at the Fifth Annual Electrical Show held at the Coliseum, Chicago, January 15 to 29, 1910. Herewith are shown a number of illustrations supplementing those published in the preceding issues.

CHICAGO PNEUMATIC TOOL COMPANY.

CONSOLIDATED ELECTRIC APPLIANCE COMPANY.



E-Z VACUUM CLEANER COMPANY.

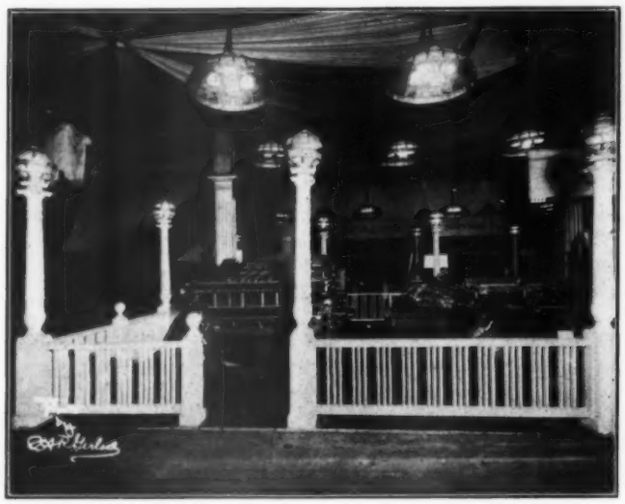
FEDERAL ELECTRIC COMPANY.

Throughout the closing week of the exposition there was a large attendance and it is expected that in point of office receipts the participation of the public has reached record-breaking proportions. While the attendance of the ultimate consumers of electricity was very large, it is feared that unless some rearrangement and classification of exhibits is made there will not be so great an attraction for the users of large apparatus as has existed heretofore. The great tendency of the manufacturers of electric heating and cooking appliances, washing machines and vacuum cleaners to take large space has discouraged the manufacturers of larger apparatus entering into central station, street railway and the telephone and telegraph field. It is highly probable that some very important changes will be made so as to bring about a beneficial mutual co-operation between the exhibitors of all classes of electrical apparatus, and give to the next electrical show held in Chicago a far greater influence and apparent value than any of the exhibitions held heretofore.

The decorative effects were highly commended, and following the elaborate productions which have been witnessed during the last three or four years it now becomes a question as to what will adequately succeed these displays. This matter will be given careful attention by the managers and architects.

Among the visitors attending the last week of the exposition were the following: L. P. Sawyer, Buckeye Electric Company; P. S. Dodd, National Electric Lamp Association; A. C. Garrison, Columbia Incandescent Lamp Company; S. E. Doane, chief engineer, Engineering Department, National Electric Lamp Association; C. E. Taylor, Bryan-Marsh Company; L. G. Martin, Okonite Company; W. N. Matthew, W. N. Matthew & Brother; and V. L. Crawford, W. N. Matthew & Brother.

A large number of out-of-town central-station men were present at various times during the progress of the Chicago Show. Among them were V



Printing Plant.

Printing and Electrotyping Machines.

Reception Room.

Tempering and Hardening Machines.

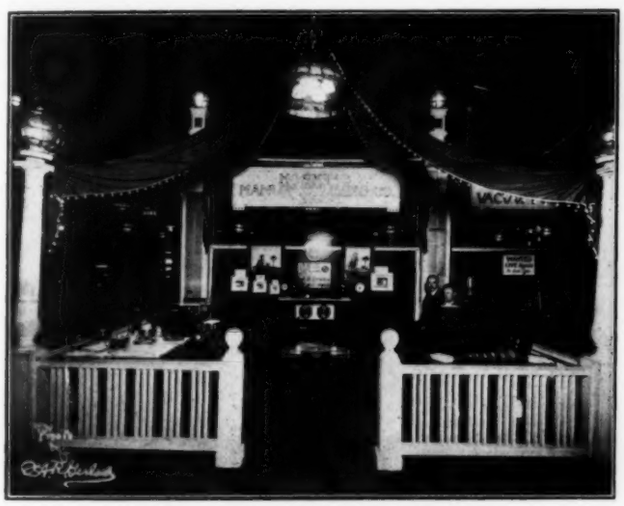
Metal Spinning and Tin Ware Machinery.

Refrigerating Machinery.

INDUSTRIAL POWER EXHIBIT, COMMONWEALTH EDISON COMPANY.

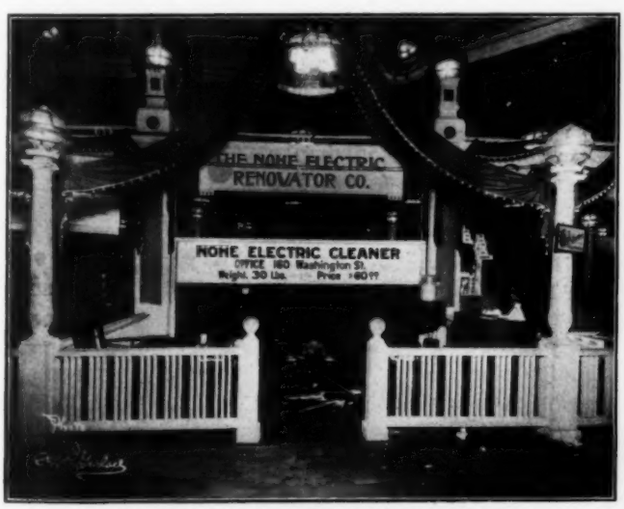
EMPIRE VACUUM COMPANY.

HOOVER SUCTION SWEEPER COMPANY.

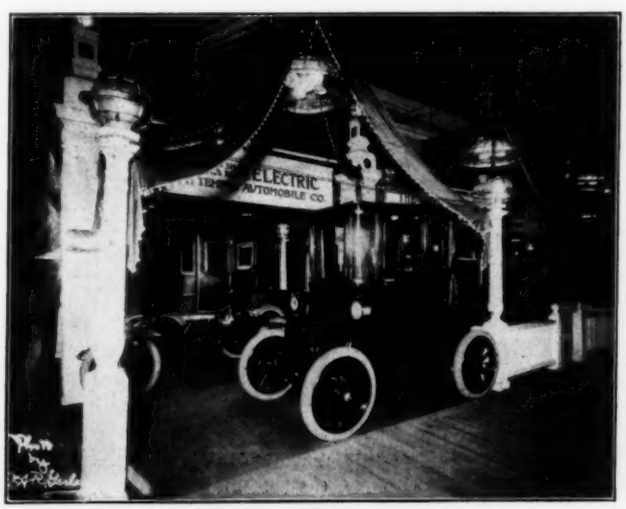


HOSKINS MANUFACTURING COMPANY.

MACBETH-EVANS GLASS COMPANY.



NOHE ELECTRIC RENOVATOR COMPANY.



RALPH TEMPLE AUTOMOBILE COMPANY.

A. Henderson, Memphis, Tenn.; W. C. L. Eglin, Philadelphia; W. F. Wells, Brooklyn; F. S. Norman, New York; T. C. Martin, New York; I. E. Moultrop, Boston; L. L. Elden, Boston; C. H. Hodskinson, Boston; W. A. Martin, Quincy, Ill.; A. G. Moser, Galesburg, Ill.; Joseph E. Montague, Niagara Falls; Wm. R. Huntley, Buffalo; George W. Ames, Buffalo; W. M. Warner, South Bend, Ind.; F. P. Ohmer, South Bend, Ind.; J. H. Harding, La Porte, Ind.; W. H. Winslow, Superior, Wis.; O. M. Rau, Milwaukee; Frank McMaster, Beatrice, Neb.; F. G. Jones, Oregon, Ill.; Chas. H. Cox, Mattoon, Ill.; E. H. Negley, Canton, Ill.; John R. Webster, Omaha; R. W. Hemphill, Jr., Ann Arbor, Mich.; A. L. Dodd, Charles City, Iowa; A. C. Sadler, Earlville, Ill.; R. B. McDonald, Fort Dodge, Iowa; C. F. Farley, Kansas City; B. M. Fast, Springfield, Ill.; G. F. Lyons, Beloit, Wis.; H. R. Kingman, Mt. Vernon, Ill.; Elmer W. Smith, Kewanee, Ill.; F. S. Armstrong, Macomb, Iowa; Louis W. Hess, Ottawa, Ill.; P. P. Crafts, Clinton, Iowa; W. E. McCollough, Beardstown, Ill.; I. B. Zimman, Omaha; Wm. A. Donkin, Pittsburg.

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

THE IRON CITY ENGINEERING COMPANY, Pittsburg, Pa., has been awarded the contract for installing electrical wiring and fixtures in the Memorial Hall at Pittsburg. The bid was awarded for $44,832.

HORN & BRANNON COMPANY of Philadelphia, Pa., has been awarded the contract for the installation of all electrical work, fixtures and fans in the new court house at Houston, Tex. Although it was first stated that no bid of over $15,000 would be accepted by the commissioners, Horn & Brannon Company's bid of $15,765 was accepted.

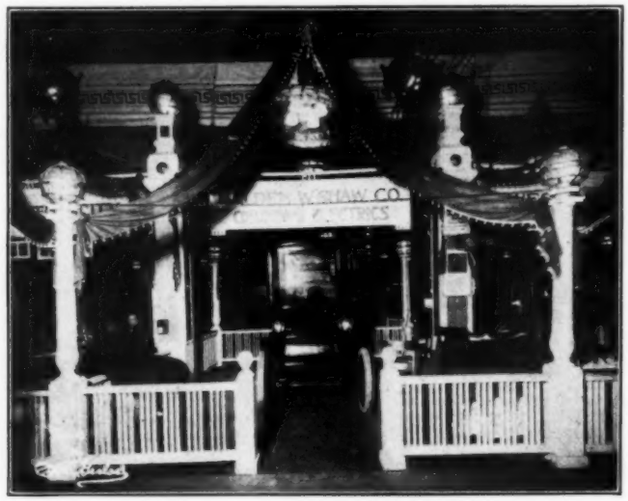
CHARLES C. MOORE & COMPANY have the contract for installing the power plant in the Perkins building at Tacoma, Wash. The same company is installing a $300,000 auxiliary steam plant in Vancouver, B. C. It was this company which supplied engines for the fireboats of New York, Chicago and San Francisco.

THE SQUIRE ELECTRIC AND CONSTRUCTION COMPANY of Kansas City received the contract for the construction of the electric light and waterworks station at Marion, Kansas. Although the specifications of this plant designated steam power engines, gas engine driven generators may be installed.

EDWARD MILLER & COMPANY of Meriden, Connecticut, have been awarded the contract for installing new lighting fixtures in the custom-house at Chattanooga, Tennessee. The bid of the company was $2,687.13. All of the present fixtures are to be removed and new combination gas and electric fixtures will be installed in their place.

THE McNERNEY ELECTRIC CONSTRUCTION COMPANY, of Cleveland, Ohio, is a bidder for the work of installing a conduit and electric wiring system and a standard clock system in the Toledo postoffice. The work must be finished by December 1, 1910. The Cleveland company sent a check for $935—ten per cent of the total—and agreed to finish the work by November 1, 1910. There are nine other bidders.

VULCAN ELECTRIC HEATING COMPANY.



WALDEN W. SHAW COMPANY.

THE CANADIAN BRITISH INSULATED COMPANY, of Toronto, Ont., was awarded the contract for putting in underground cables for the power system of Toronto. The contract price for the work was $55,000.

THE UNION GAS AND ELECTRIC COMPANY of Cincinnati, Ohio, was granted the contract for installing the lighting system at Inwood Park. The contract was let to this company by the park commission, for $4,980.

THE FARGO PLUMBING AND HEATING COMPANY, Fargo, N. D., received the contract for wiring and installing electric lights in the county hospital. The contract price was $949.

THE SANBORN-MARSH ELECTRIC COMPANY, 115 North Illinois Street, Indianapolis, Ind., announces that on January 1, G. M. Sanborn and A. W. Sanborn acquired the interests of H. B. Marsh in the company.

B. & O. Railroad Adopts Electric Lights.

Within a short time the sleeping-car and parlor-car equipment of the Baltimore & Ohio Railroad will be electrically lighted throughout. Arrangements have been made for wiring the cars and installing apparatus for generating the eletric current by axle-driven dynamos. In addition to the general lighting, individual berth lights will be placed in the sleeping cars.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

NORTHERN OHIO TRACTION AND LIGHT.

The report of the Northern Ohio Traction and Light Company for the month of December and twelve months ended December 30, compares as follows:

	1909	1908
December gross	$ 182,912	$ 160,454
Expenses	101,555	86,147
December net	$ 81,357	$ 74,306
Charges	43,209	43,999
December surplus	$ 38,148	$ 30,307
Twelve months gross	2,177,642	1,890,473
Expenses	1,190,057	1,086,423
Twelve months net	$ 987,585	$ 804,050
Fixed charges	524,066	526,532
Surplus	$ 463,519	$ 277,517
Dividends	157,500	134,151
Surplus	$ 306,019	$ 143,366

UNITED RAILWAYS OF ST. LOUIS.

The United Railways of St. Louis reports earnings for the year ended December 31, 1909, compared as follow:

	1909	1908
Gross	$11,111,431	$10,593,166
Surplus after charges	1,285,071	1,056,968
Preferred dividend	849,160	849,160
Surplus	$ 435,911	$ 207,808

CHICAGO RAILWAYS COMPANY.

The Chicago Railways Company report of estimated earnings for the year ended January 31, 1910, compares as follows:

	1910	1909
Gross	$12,442,000	$11,037,071
Expenses and taxes	8,709,220	7,725,950
Net	$ 3,732,780	$ 3,311,121

BINGHAMTON RAILWAY COMPANY.

The Binghamton Railway Company reports gross earnings for the quarter ended September 30, 1909, of $98,276, against $91,202 last year, and net earnings, after expenses and taxes, $42,301 against $34,262. There remained a surplus, after charges, of $19,020, against $11,875 last year.

ONEIDA RAILWAY COMPANY.

The Oneida Railway Company reports gross earnings for the quarter ended September 30, 1909, of $122,312, against $113,088 last year, and net earnings after expenses and taxes of $60,839, against $60,084 last year. There remained a surplus after charges of $55,159, against $54,939 last year.

SOUTH SIDE ELEVATED.

The report of the South Side Elevated Railroad, of Chicago, for the year ended December 31, 1909, compares as follows:

	1909	1908
Passenger	$2,136,131	$2,149,730
Advertising and misc.	98,840	91,959
Total gross	$2,234,971	$2,241,689

OPERATING EXPENSES.

Maintenance of way	$126,574	$128,588	$114,081	$ 77,984
Maintenance of equipment	156,150	178,605	168,669	144,317
Cond trans.	746,575	758,105	677,482	534,945
Sup. rental & expenses	281,599	293,320	205,900	258,363
General	213,054	212,446	293,613	191,658
Total	$1,523,954	$1,571,065	$1,459,745	$1,207,267
Net earnings	711,018	670,624	645,447	581,706
Interest and rent	453,080	436,620	205,939	.....
Surplus	*$257,938	$234,004	$439,508	.....

*Equal to 2.49 per cent on $10,328,800 capital stock, compared with 2.26 per cent earned on same stock last year.

The South Side Elevated Railroad Company's total traffic for 1909 was 42,722,624, as against 42,994,610 last year. The daily average was 117,048, a decrease of 0.36 per cent.

COLUMBUS RAILWAY AND LIGHT.

The Columbus Railway and Light Company's annual report, for the year ended December 31, 1909, compares as follows:

	1909	1908
Gross	$2,577,202	$2,281,951
Expenses	1,290,133	1,185,604
Net	$1,287,069	$1,096,347
Other income	17,866	18,795
Total income	$1,304,935	$1,115,142
Fixed charges	971,707	920,253
Balance	$ 333,227	$ 194,889
Depreciation, etc.	72,875	47,765
Surplus	†$ 260,352	$ 147,124
Dividends	* 200,877	100,000
Surplus, year	$ 59,475	$ 47,124

*Includes $75,877 paid to employes under the profit-sharing plan. †After deducting employes' dividend of $75,877, is equal to 5.3 per cent on capital stock.

LEHIGH VALLEY TRANSIT.

The annual report of the Lehigh Valley Transit Company for the fiscal year ended November 30, 1909, compares as follows:

	1909	1908
Passenger receipts	$956,888	$910,574
Operating expenses	548,172	561,240
Net	$408,716	$349,334
Other income	114,574	128,052
Total income	$523,290	$477,386
Fixed charges	421,602	420,783
Surplus	$101,688	$56,602

AMERICAN DISTRICT TELEGRAPH COMPANY.

At the annual meeting of the American District Telegraph Company Union N. Bethell was elected a director to fill a vacancy. All other directors were re-elected. The statement for the year shows net earnings of $84,563, equal to 2.2 per cent earned on capital stock, as compared to 1.77 per cent last year.

Revenue from all sources	$549,225	Inc. $56,329
Expenses, all classes	464,661	Inc. 39,871
Net	$ 84,563	Inc. $16,457
Dividends	76,888	Unchanged
Surplus	$ 7,675	Inc. $16,457

President R. M. Clowry said at the annual meeting: "The figures submitted show a substantial recovery from the depression of the previous year and a gratifying increase in revenue, notwithstanding that the amount expended on construction account was $5,371 more than in 1908. The increased business has been handled without complaint and frequent tests have demonstrated that response to calls has been made promptly and reliably.

"There were 321,795 more telegrams delivered and 188,414 more collected than during the previous year. Our call box service was installed in forty-two new offices and apartment buildings during the year, and at the close 35,875 boxes were in operation. The regular appropriations for dividend amounted to $76,888."

Copper Merger Realized.

According to an official statement made by John D. Ryan, president of the Amalgamated Copper Company, the $1,000,000,000 copper merger has at last been brought about.

The Anaconda company, which is the nucleus, will take over the securities of the Cole-Ryan Amalgamated Copper Company and also the Guggenheim companies. The capital will be increased from $30,000,000 to $150,000,000.

Concerning the plan to merge the various properties in the Butte district, the Amalgamated company in its statement says:

"The reasons for the proposed increase in stock involve consideration of difficult and complicated legal questions as well as those relating to the economical and efficient management of business operations of the different companies.

"What is known as the law of the apex or the right to follow a vein on its dip extra-laterally beyond the surface lines of mining claims prevails in Montana, and has given rise to many perplexing problems in connection with operators in the Butte district.

"Mining claims of the Anaconda Copper Mining Company and the other companies affected by this plan are all located within a comparatively circumscribed area and are contiguous and so closely and inextricably interlaced as to make almost impossible the segregation of ownership of underground ore bodies."

The companies that will go into the merger include:

	Capitalization.
Amalgamated	$155,000,000
Anaconda	30,000,000
Utah Copper Company	25,000,000
Boston and Montana	3,750,000
Butte and Boston	2,000,000
Parrott Silver and Copper Company	2,298,500
Washoe Copper Company	5,000,000
Colorado Smelting and Mining Co.	2,500,000
Butte-Coalition	11,000,000

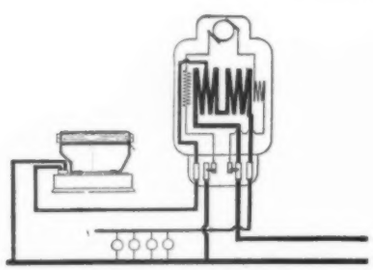
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A Combined Light and Power Meter.

A new meter, which should do much to encourage the use of electrical domestic appliances, says *Electrical Engineering*, of London, England, has been introduced by the Admil Electric Company, Ltd., of London. This comprises a standard lighting meter fitted with an additional terminal, which is connected inside the meter to the main current coils. The connection is made in such a manner that the current taken by the heating, cooking, or other appliance does not flow through all the turns of the main current coils, but only through a portion of them dependent on the ratio of the power tariff to the lighting.

The current taken by the lamps in the installation flows through the meter coils in the ordinary way. The meter thus registers the units consumed for lighting, and, in addition, that proportion of the power consumption which, charged for at the lighting rate, equals the total power consumption charged



THE LIGHT AND POWER METER.

for at the power rate. To deduce the total bill for lighting and power, the total units registered by the meter must therefore be multiplied by the lighting rate.

The method of connection for a direct-current meter is illustrated diagrammatically in the accompanying figure, in which the special power terminal is shown connected to one-half of the series windings. In this case the ratio of the power and lighting rates is assumed to be 1:2—e.g., six cents for power and twelve cents for lighting; it will also be seen that it is only necessary to run one extra main back to the meter from the heating apparatus, etc., and connect it to the power terminal.

Should the power rate be only one-third of the lighting rate, the power terminal is joined to a tapping on the main current coil, so that only one-

FIG. 1.—ELECTRIC HAMMER USED VERTICALLY.

third of the total number of turns is in series with the power circuit. Both alternating-current and direct-current meters of this type can be obtained, and for any ratio of lighting and power rates, and as the prices are only slightly in

FIG. 2.—ELECTRIC HAMMER USED HORIZONTALLY.

excess of those for ordinary meters, they should be of considerable use where flat rates are in vogue.

Consul S. C. Reat, of Tamsui, reports the installation of wireless telegraph stations in the Island of Formosa.

New Type of Electric Hammer.

The Electro-Magnetic Tool Company, 115 South Clinton Street, Chicago, Ill., has placed on the market a tool known as its Model 5 hammer, views of which are shown herewith. It is an electrically operated percussion device, which is recommended for drilling in concrete, brick and stone.

The Model 5 hammer of the Electro-Magnetic Tool Company differs from most of the previous designs, in that

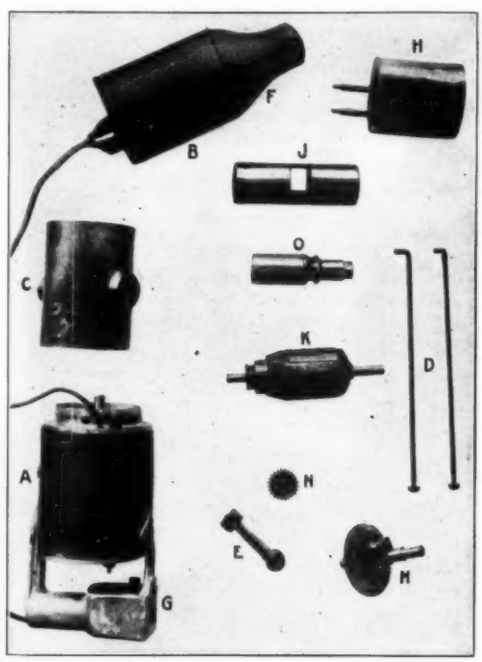


FIG. 3.—DETAILS OF HAMMER.

there are no make and break contacts in its construction, no flexible shaft and no reversing of the current in the solenoid. The electromagnet in this tool acts merely as a magnetic clutch, and the magnetic field is shifted by means of a light sleeve.

An excellent idea of the construction of the tool may be obtained from Fig. 3, which shows the detailed parts. The total length of the tool is twenty-four inches, the maximum diameter five and one-half inches. The frame consists of two pieces of steel tubing, A and B, separated by a brass gear case C, and bound together with the two tie rods D. The nosepiece F is of brass and the handle G of cast aluminum. In

the lower section of the drill frame B is located an electromagnet or solenoid H designed to exert a pull of one hundred pounds. Within the solenoid is a steel sleeve J operated through the gears M and N, and the connecting rod E, by a small series motor K installed in the upper portion of the drill frame. The hammer element O, weighing two and one-half pounds, is located inside the sleeve. It is not connected mechanically or electrically with any other portion of the drill and is absolutely free to move.

The tool is totally enclosed to prevent dust or dirt from entering the working parts. Interior nuts and bolts are securely fastened which renders loosening or loss impossible. The gears and rubbing surfaces are all of case-hardened steel to prevent wear. The bearings are of bronze, liberally designed and provided with adequate means of lubrication, and all electrical connections are thoroughly bushed and insulated.

The shifting of the sleeve by means of the motor, gears, and connecting rod, is in effect the same as though the whole magnet were moved, and when the striking element impinges on the drill-shank the magnetic cushion between the sleeve and this element prevents vibration and jar from being felt in the gears or crank shaft.

The advent of a successful electric hammer should be favorably received by the army of contractors who find it necessary to do drilling for expansion casings and piping in modern building. It is an expensive operation and by hand very tedious.

The Model 5 hammer consumes three and one-half amperes at 110 volts. It may be attached directly to any direct-current lighting circuit, and as power is almost always available, it makes an extremely convenient and economical tool.

Georgia Railroads Must Report Accidents.

The Railroad Commission has issued an order which became effective February 1, requiring all electric and steam roads to make immediate telegraphic reports of all accidents occurring, to be followed in forty-eight hours by a report by mail, and it is further provided that a full report of all accidents shall be submitted by the 10th of each month covering the entire preceding month.

Kimble Polyphase Induction Motors.

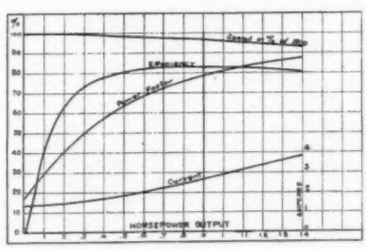
A new line of high-efficiency polyphase induction motors has just been placed on the market by the Kimble Electric Company, 1121-1123 Washington Boulevard, Chicago. These motors were designed by Prof. J. D. Niesz, of Lewis Institute, and were exhibited to the public for the first time at the Chicago Electrical Show just closed. They are made in sizes from one-fourth to seven and one-half horsepower.

In these motors the polar area is

KIMBLE POLYPHASE INDUCTION MOTOR.

large, which permits the use of a much lower value of the no-load current than is usual; this contributes to an improvement of the power factor at all loads, and indirectly to the improvement of the efficiency through a reduction of the copper loss.

The pitch of the stator winding is chosen to give a magnetic field of maxi-



TEST CURVES OF ONE HORSEPOWER, 220-VOLT, SIXTY-CYCLE, THREE-PHASE, FOUR-POLE, KIMBLE MOTOR.

mum smoothness. The field being almost sinusoidal, but little damping action is required of the rotor, and the losses due to stray currents in the rotor are very small. The use of the selected winding pitch results in short coil ends, leading to a reduction of the magnetic leakage, and also to a reduction of the stator copper losses.

These motors are not designed for high starting torque, but rather for low slip; the starting torque is ample for most purposes, however, and higher than is usually obtained in motors of the same efficiency and slip. These results are due to the smoothness of the motor field, which causes any back torque due to the rotor's damping action to be eliminated.

The efficiency of these motors is high and sustained through a wide range, and the power factor is exceptionally good. The arrangements of the parts is such as to secure a free dissipation of heat, and the result of this is that the rating is conservative.

The tendency in these designs is towards short lengths and large diameters. This feature permits the use of short stiff shafts, running in good sized bearings set close together, so that no trouble is likely to occur in these motors on account of sprung shafts or contacts between the stator and rotor iron.

The outer surface of the rotor is made smooth, which together with the smoothness of the field makes the motors nearly noiseless when in operation.

Two Fine Mazda Bulletins.

The National Electrical Lamp Association distributed two very interesting booklets at the exhibit of the Engineering Department at the Electrical Show held in the Coliseum, January 15 to 29.

The one entitled, "Short Catalogue of Mazda Lamps," presents on behalf of the member companies of the association some interesting information and data on this line of highly perfected metal-filament lamps. The catalogue describes the leading features of the Mazda lamp, gives an abridged catalogue of Mazda lamps, a list of member companies of the National Electric Lamp Association, a list of the Chicago dealers in Mazda lamps and a catalogue of the bulletins published by the Engineering Department of the Association. The pamphlet is well printed and well illustrated and is of a convenient pocket size.

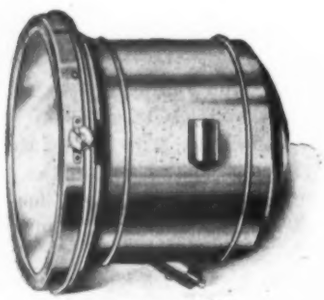
The other booklet is entitled, "Mazda Means Electric Light for Everybody." This is an epic on the development of incandescent lamps and presents a strong argument from the central-station point of view. It is a rara avis in literature of this character and will be read with much interest by manufacturer, central-station man and customer alike.

The "Hyray" Automobile Lamp.

Every autmobilist knows the troubles and inconveniences that are usually prevalent with the use of gas or oil lamps, either as headlights, sidelights or taillights. Such lamps are frequently extinguished by the jarring of the machine or more often by the wind. They also require more or less care to keep them in proper working order and to maintain their efficiency at its highest point.

The owner of an automobile is interested in a lamp that will give plenty of light, one on which he can absolutely depend and one which requires a minimum of attention.

The "Hyray" electric lamp outfit designed by the Electric Storage Battery Company of Philadelphia, Pa., is believed to meet the above requirements, and should therefore be of particular interest to every owner of a self-propelled machine. The Hyray lamp is furnished complete in Japan or brass



THE "HYRAY" AUTOMOBILE LAMP.

finish for replacing oil or gas lamps. Hyray fittings have also been designed that can be attached to the standard types of oil or gas lamps now in use, thus giving the advantages of the electric lamp without the necessity of purchasing entire new fixtures.

This electric lamp is operated by an Exide storage battery, which is readily carried on the running board of the machine and occupies but a small space. Switches, placed at any point convenient to the operator, turn the lights on or off, separate switches being installed to operate headlights, sidelights and taillights. The lights are switched on or off without the motorist leaving his seat. The outfits are so arranged that small electric lamps can be used for sidelights and taillights, while larger ones are installed in headlights; the latter even more brilliant than the ordinary acetylene automobile headlight.

Automatic Control for Motor-Driven Pumps.

One of the most interesting applications of the electric motor is to the performance of operations which are of so rare occurrence as to make the presence of an attendant an expensive luxury. For such service electricity is an ideal source of power, as it admits of automatic control, is always ready for instant use, and costs nothing except when it is being used. There is no delay waiting to get up steam and its use

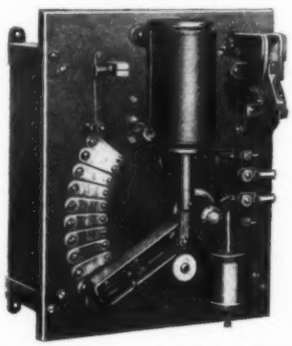


FIG. 1.—AUTOMATIC MOTOR CONTROL.

FIG. 2.—AUTOMATIC MOTOR CONTROL.

is not attended with odor, noise, or steam. The motor and controlling apparatus occupy very little space and may be installed on the wall or ceiling where it will be out of the way. Such a device becomes a servant that needs no watching and never forgets.

An excellent example of the utility of the electric motor equipped with automatic control is its application to the operation of pumps required to maintain a certain water level in a tank. If the water level falls below a certain predetermined value the controlling device automatically starts the motor and the pump continues to operate until the water level is raised to a predetermined value when it ceases to operate.

Figs. 1 and 2 illustrate a device manufactured by the General Electric Company, Schenectady, N. Y., for the service described above, while Fig. 3 shows the manner of its operation. The length of the chain attached to the ball of the float switch is so adjusted that when the water level falls below a certain point, the arm of the float switch is raised sufficiently to close the motor cir-

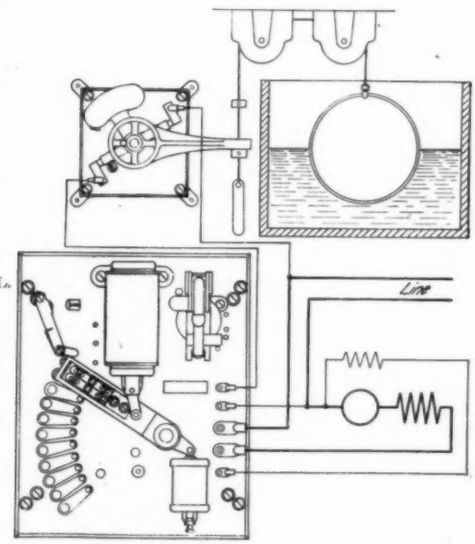


FIG. 3.—DETAILS OF AUTOMATIC CONTROL.

cuit and start the pump which continues to operate until the ball rises and allows the weight to carry the arm of the float switch down far enough to open this switch and disconnect the motor from the line. From Fig. 3 it is easily seen that the length of the chain and the position of the button on it may be adjusted so as to locate the critical water level at any desired point.

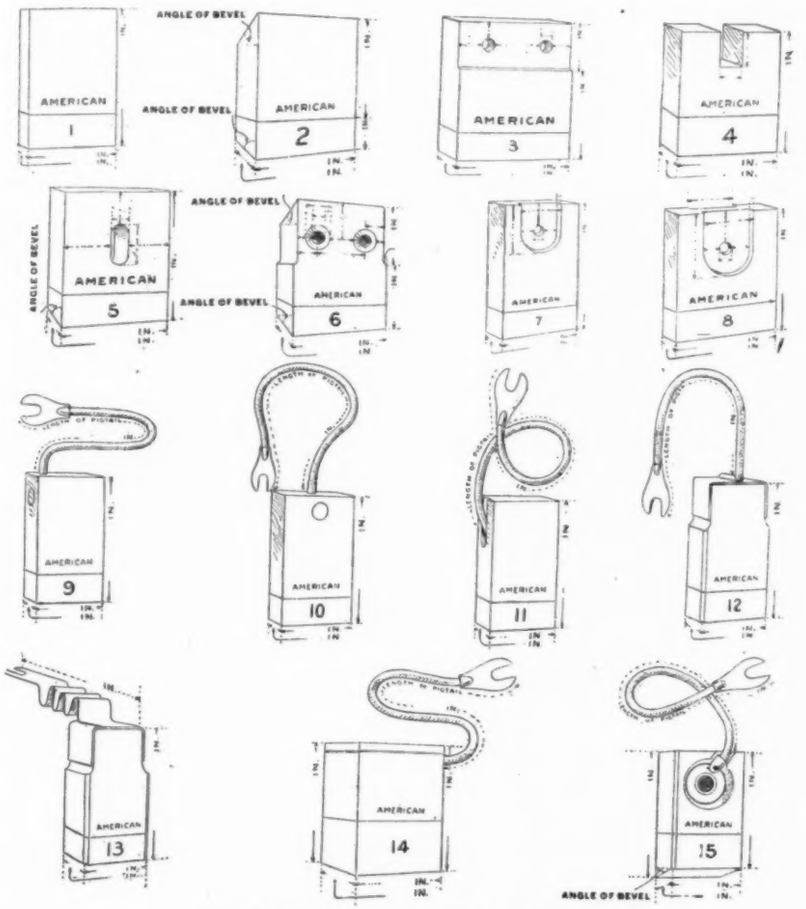
Except in smaller sizes the motor circuit is opened by an auxiliary switch provided with a strong magnetic blowout device which prevents an arc forming when the motor is disconnected from the line and eliminates any fire hazard that might result from a poorly designed piece of apparatus. The same device will operate to maintain any desired fluid or air pressure if supplied with a pressure governor instead of a float switch.

The General Electric Company manufactures such a controlling device for every type of motor.

A Novel Order Blank for Carbon Brushes.

The diagram given below is a reproduction of one side of a novel order for carbon brushes which is being distributed (on application) by the American Carbon and Battery Company (manufacturers of carbon and graphite brushes for dynamo-electric machines), of Signal Hill, East St. Louis, Ill.

On the other side of the order sheet is a printed form on which the purchaser is supposed to fill in, under given heads, all the instructions necessary for filling an order.



ORDER BLANK FOR CARBON BRUSHES.

The order sheet is designed to obviate the omission of important data which should be supplied by intending purchasers, and to afford the buyer the most suitable grade of material for the purpose in view. Another consideration worthy of note is that the order sheet, when properly filled in on the first application, will enable the manufacturers to fill orders accurately and promptly without further correspondence.

Western Electric Business Good.

The Western Electric Company closed its fiscal year on November 30 with a substantial recovery in business from the previous year. The year 1909 shows total sales of approximately $46,000,000.

The company is looking forward to an increased business for 1910, not only in the business with the Associated Telephone companies, but also with telephone customers outside the Bell system, both of which will feel the results of improved business conditions. Industrial plants and central stations are either getting ready or have prepared for a greater volume of business for 1910, which will make them larger consumers of motors and electrical supplies. Indications point to especial improvement in motor, dynamo, telephone apparatus and cable lines.

The Bureau of Steam Engineering of the United States Navy Department officially predicts an increased use of producer-gas-engine plants in the navy.

The Santo Vacuum Cleaner.

That the electric vacuum cleaner is now becoming a factor worthy of consideration by central stations who are striving to increase their day load, is indicated by the popularity of these cleaners in residences, hospitals, hotels, etc.

Among the cleaners which are sharing this popularity may be mentioned the Santo electric vacuum cleaner, which is manufactured by the Keller Manufacturing Company and is being placed on the market by Charles Strader & Company, 155 Wabash Avenue, Chicago, Ill.

The Santo cleaner, illustrated herewith, is cylindrical in shape, is fitted with handles and is mounted on ball bearing casters. However, it weighs but forty pounds and may be easily carried when necessary. The top

THE SANTO VACUUM CLEANER.

and base are cast aluminum, polished and lacquered. The round case is made of light, strong sheet steel covered with pantasote or chase grain leather in black, maroon or olive green as may be desired.

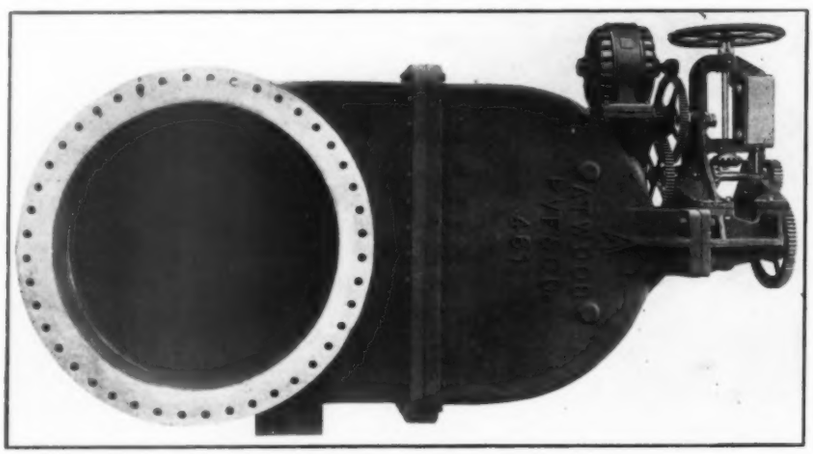
On the top is a socket for the suction hose and an observation glass which permits of seeing the dirt as it enters the dust chamber. A socket for the blowing hose is located in the side near the base.

The suction is produced by a specially designed vacuum pump operated by a one-eighth horsepower electric motor, direct-connected by ball bearing eccentrics, which is claimed to run continuously without overheating. It is also claimed that the Santo will produce a maximum vacuum of 7 to 8 inches and that it has a calculated displacement of 25 to 30 cubic feet of free air per minute.

According to Lloyd's Register for 1908-9, there were 404 vessels recorded as being fitted with wireless telegraph apparatus, and 362 vessels with submarine signaling devices.

Large Alternating-Current Motor-Operated Gate Valve.

The large alternating-current motor-operated gate valve shown in the accompanying illustration is installed at the plant of the Pressed Steel Car Company, McKees Rocks, Pa., where it is inserted in the exhaust line from a 1,000-kilowatt Westinghouse low pressure turbogenerator to the condenser. The valve closes upon a clear opening 48 inches in diameter, and is operated sixty-cycle, 550-volt Westinghouse type CCL induction motor. The motor speed by a three-horsepower, three-phase, motor of 1,120 revs. per minute is reduced through suitable gearing to the speed of the main operating thread, provided for closing the valve safely and quickly. A hand wheel for hand closing is also provided. A worm gear



LARGE MOTOR-OPERATED GATE VALVE.

on one of the intermediate shafts operates a limit switch mechanism, which automatically controls the movement of the gate by stopping the motor at a certain point in the gate travel either way.

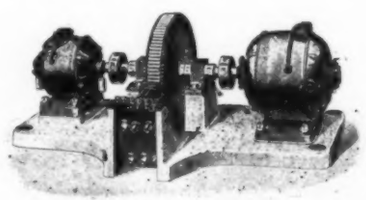
To open or close the valve, it is thus necessary only to throw the operating switch into the corresponding position, starting the motor which continues to run until it is automatically cut off when the end of the valve travel is reached. The valve is thus operated with the absolute minimum of effort or trouble, and can be closed or opened at the predetermined safe operating speed as easily as switching on an electric light. The limit switch which accomplishes this automatic control is enclosed in the box shown at the right of the valve gear. The operator's switch, by which the valve is opened or closed, may be located in any convenient position about the building or plant.

The assembly of the motor and gearing in the instance shown was a special construction made necessary in clearing neighboring pipes and walls. Applications of alternating-current motors for control services of this kind are yet in the classification of novelties, but the excellent performance of this apparatus has demonstrated that the induction motor is rapidly coming to occupy the wide field in which the direct-current motor has already proven so pre-eminently the ideal motive power.

The forty-eight-inch gate valve illustrated was designed and built by the Pittsburg Valve Foundry and Construction Company, Pittsburg, Pa., and the motor and limit switch device were furnished by the Westinghouse Electric and Manufacturing Company.

A High-Frequency Generator.

Among the many interesting devices shown at the Physical Society's recent exhibition in London, England, was the Siemens high-frequency generator illustrated herewith, which is designed for a normal frequency of 3,500 cycles a second. This machine is driven by a motor, and, instead of having an eddy-current brake, as in a previous model, is provided with a loading generator. With a 220-volt circuit the machine will develop a maximum frequency of 6,000 cycles a second.



HIGH-FREQUENCY GENERATOR.

A New Window Reflector.

In line with the advances which have been made in scientific illumination during the last few years, much attention has been given to the matter of properly lighting up store windows.

The latest development in this direction is the "Scoop" reflector, so-called owing to its peculiar shape. This reflector consists of a one-piece pure silver-plated reflector and tests made indicate a very high efficiency for it.

The reflector takes a tungsten lamp in the pendant position and is so designed that it will reflect the rays of light correctly with the forty-watt, sixty-watt and 100-watt sizes. It is

A NEW WINDOW REFLECTOR.

easily attached to the ceiling, an ordinary socket and crowfoot being used. The window side of the reflector comes in at a slight angle which cuts the rays of light sharply at the lower window line, bringing the greatest intensity of illumination just where it is required throughout the window and decreasing the brilliancy at the upper part and the back trim.

Brill Thesis Contest.

A thesis contest inaugurated by the great Philadelphia electric-car-building firm of J. G. Brill and Company, in 1908, for theses on timely topics announced by the company, has been continued for 1910. The subject selected for this year is "Design of an Electric Railway Car for Street Service." Three prizes, $250, $150 and $100, are offered to senior students of colleges, universities and technical schools.

Current Electrical News

CONTINENTAL EUROPE.

(*Special Correspondence.*)

PARIS, JANUARY 18.—In the Mediterranean region electrical affairs are active at the present time. Among others is to be noted the project which is now being discussed by the municipal council of Nice. According to the present plans there will be erected a hydraulic plant of large size at the locality of St. Pons, and in connection with it will be constructed a large storage reservoir at Rimiez. The station will supply current for Nice and the neighboring district along with the present plants. The Energie Electrique company is continuing to extend its network of hydraulic plants and power lines in this region. One of the plants of most recent construction lies on the Vis River in the neighborhood of Montpellier, and a 350-foot head of water has been obtained at this point. The plant is laid out on the three-phase 30,000-volt system and it will feed into the existing network so as to afford a reserve to other plants, at the same time supplying the localities in the vicinity. There are now five turbine-alternator sets of 1,500 horsepower of the Alioth type erected in the station. At Nimes there is installed a substation of some size.

In Roumania there has been formed at Giurgero a company for public and private electric lighting.

Samarcand, in Russia, is to have an electric tramway line in the near future. Another Russian enterprise is the construction of an electric lighting plant at the town of Kaluza.

The Prussian state railroad is to award the contract for a number of motor-driven car transporters for use at stations for handling trains. One of these will be installed at the station of Potsdam.

In Austria the commune of Grottau in Bohemia is taking measures for installing an electric light plant. A new electric railroad has been opened not long since, known as the Dermulo-Mendelpass. It connects the terminal station of the existing Mendel railroad with the station of Dermulo, this latter being located on the Trient-Malé electric road. Two substations containing rotary converters are located, one at Romeno and the other at Mendelpass, both receiving 3,600-volt three-phase current, which is converted to 800-volt direct current. A. DE C.

EASTERN CANADA.

(*Special Correspondence.*)

OTTAWA, January 29.—A new radial railway company, to be known as the Monarch Company, is applying to the Ontario legislature for incorporation. It is proposed to run from Toronto through the counties of York and Simcoe; provide a street railway for the towns of Barrie and Orillia, and an express service between Barrie and Toronto, scheduled to make the run of sixty-five miles in an hour and a half.

The Mexican Power Company's statement for December shows the largest gross and net earnings of any month in the year. It was probably the best month, in respect to operating conditions, that the company has ever had, and indicates that the troubles incident to the Necaxa dam collapse have been surmounted. As a matter of fact, however, the company earned scarcely anything on the stock for the year, owing to the dam disaster. For the fiscal year, gross earnings amounted to $6,035,040; expenses $2,985,458, and net $3,049,582, in Mexican currency. Taking a low estimate of interest and other fixed charges of $2,500,000, it is seen that there is only a matter of some $250,000 gold, available to meet the four per cent dividend paid during the year.

The Mines Power Company, which is building its plant on the Matabitchouan River, in the Cobalt district, states definitely that it will be able to supply customers with electricity and compressed air by February 25. The Cobalt Hydraulic Company which is piping air from Ragged Chutes, on the Montreal River, states that by February 21 it expects to be in a position to supply compressed air to the silver mines, so that in the desperate race to be in the camp first, the chances seem to be even.

R. S. Kelsch, of Montreal, has been retained by the new Quebec electric merger interests to consolidate the various properties now controlled by the merger. The amalgamated electric companies are now operating electric systems of different frequencies, voltages, phase, etc. The operating of all plants will be so rearranged as to operate the properties as a unit, and, when completed, the operating costs will be greatly reduced and the capacity of the several plants increased. At the present time, there are eight electric light plants and two gas plants comprised in the merger. The consolidation of the properties will be commenced at once, and it is expected will be completed within one year. About $1,000,000 will be expended and when the work is finally finished, it is claimed that Quebec will have one of the best properties in the Dominion. W.

MEXICO.

(*Special Correspondence.*)

MEXICO CITY, JANUARY 28.—G. A. Mitchell of London, Eng., and associates who are interested in the Michoacan Railway and Mining Company and the Michoacan & Pacific Railway Company, are preparing to utilize the waterfalls near Zitacuaro, state of Michoacan, for the development of a large amount of electrical energy. The site of the proposed hydroelectric plant has been selected. The power will be transmitted to mining districts and industrial centers of this region.

Aristides Betancourt of Mexico City has made application to the federal government for a concession to establish a large factory here for the manufacture of dynamos and various kinds of electric machinery and equipment. He agrees to invest not less than $150,000 in the industry.

The American Smelting and Refining Company is installing a large electric power plant at its smelter near Chihuahua.

The government of Pachuca, state of Hidalgo, has granted a concession to Francisco Martinez Arauna of Pachuca, for the construction of a hydroelectric plant on the Tepeji River. He will furnish light and power for the city of Tepeji del Rio.

The Sierra Consolidated Mines Company which has its headquarters at Duluth, Minn., is preparing to construct a hydroelectric plant in the vicinity of its mines near Parral, State of Chichuahua.

The Mexico Light and Power Company is arranging to extend its light and power service to thirty more towns and villages in the valley of Mexico. Contracts have already been made for this service in Texcoco, Xochimilco, Santa Anita, Ixtacalco, San Juanico, Mexicalzingo, Culhuacan, Ixtapalapa, Hastahuacan, Meyehualco, San Lorenzo, Hacienda San Nicholas, Zapotitlan, Tlaltenco, Reyes, San Sebastian, Zapotla, San Mateo, Magdalena, Aculco, Santiago, Santa Marta, Santa Catarina, Mas Arriba, Santa Maria, San Antonio, Tomatlan, La Turba, La Purisima and San Pedro Atzcapotzaltongo. The transmission cables to these towns are now being strung.

The Central Mexico Light and Power Company has purchased all of the holdings of the Electric Light and Power Company of Leon, State of Guanajuato. The former company has also acquired the concessions to use the water of the Guero waterfalls for the generating electricity and to build transmission lines to Leon and various other places in this part of the state of Guanajuato. It is stated that the price paid for the property of the local company was about $900,000 Mexican currency. The Central Mexico Light and Power Company is said to be a subsidiary concern of the Guanajuato Light and Power Company. It recently issued bonds to the amount of $2,500,000 gold, all of which were quickly subscribed in New York. The proceeds from the sale of these bonds will be used to construct a large hydroelectric plant at the Guero waterfalls. This plant is already partly constructed. It will have a capacity of 20,000-horsepower. The city of Leon has a population of about 80,000 people and is one of the most important manufacturing centers in Mexico. The company will not only supply Leon with lights and power but it will build transmission lines to the great plantation of Oscar Braniff where the power will be used to operate irrigation pumps and for other industrial purposes. D.

IMPORTANT DEVELOPMENTS.

(*Special Correspondence.*)

TO BUILD $1,000,000 PLANT.—The Southern Power Company has bought land in the suburbs of Greenville, S. C., on which will be erected a plant for electric power, entailing an expenditure of something like $1,000,000. This plant will be used as an emergency station, it is understood.

POWER FOR DUCKTOWN PLANTS—The Carolina-Tennessee Power Company is ready to start work in the early spring on a $5,000,000 power plant, the main object of which is to furnish power for the two big copper plants at Ducktown, Tenn. Two dams will be built on the Hiwassee River, one at Appalachia and the second twenty miles above Appalachia. They will generate sixty thousand horsepower. All property rights for the overflow lakes have been secured. Five hundred men will be put to work as soon as the weather will permit. New York and Boston capitalists are behind the enterprise. Towns as far south as Dalton, and Rome, Ga., and as far north as Athens, Cleveland and Sweetwater, are to be supplied with electric current.

TO MERGE PENNSYLVANIA TROLLEY LINES.—E. R. Sponsler, president of the Columbia Power, Light and Railways Company, has announced at Bloomsburg, Pa., the consummation of the merger which he, with Meikleheam & Dinsmore, New York

bankers and electric railway operators, controls, whereby they have merged all the electric railways between Berwick and Pottsville, Pa., as well as twenty electric light and four gas plants. The electric railways absorbed are the Danville & Bloomsburg, Columbia & Montour, Northumberland Light, Heat and Railways, Shamokin & Edgewood, Shamokin & Mt. Carmel and the Schuylkill Railways Company. By the construction of sixty-five miles of electric railway the company will own 142 miles of road, the only remaining links necessary to connect Scranton and Wilkes-Barre with Philadelphia, via Pottsville. Twenty miles of railway will be constructed to connect the Columbia & Montour system with the Wyoming Valley lines, and the construction of ten miles of road between Danville and Sunbury will complete the link as far as Sunbury, and other short links and extensions will be made. It is expected that the purchase and improving of the properties will mean the expenditure of about $7,000,000. Power for operating not only the railways system, but for electric lighting as well, will be procured from the Harwood Electric Company.

SOUTH CAROLINA TRACTION PROJECT.—Another large interurban trolley enterprise, the Carolina Traction Company, has been chartered at Columbia, S. C. It proposes to link the towns of Rock Hill, Chester and Charlotte, and later connect Yorkville and other towns within a radius of thirty miles from Rock Hill so as to form a network of lines aggregating about 150 miles. The company has an initial capital of $150,000, and an ultimate capital of $500,000. The president of the company is J. M. Cherry, of Rock Hill, which is to be the headquarters of the company.

COMPLETING BIG COLORADO DAM.—It is announced that work is to be resumed in a short time on the upper part of the immense dam being constructed by McArthur Brothers Company for the Colorado Power Company, at Nederland, Colo. The contractors were compelled to suspend building operations on that section in November for the winter. Meanwhile they have closed up the lower openings and placed the structure in shape to retain the spring flood waters. The dam, when completed, will be 186 feet above the foundations, constructed of solid concrete. The power plant is nearing completion and will be ready to operate with the start of the flood waters in Boulder's Creek this spring. The new dam will be the largest in Colorado, costing about $600,000. The Colorado Power Company, for which it is being built, has a capital of $22,500,000 and is backed by ex-Governor Myron T. Herrick, of Ohio, and Colorado capitalists. Its purpose is to exploit the electrical capabilities of Northern, Eastern and Central Colorado.

LIGHTING AND POWER.

(Special Correspondence.)

DURANT, OKLA.—This city has voted electric light bonds to the amount of $20,000. P.

VAN HORN, TEX.—John E. Cox is figuring on the establishment of an electric light plant. P.

ORLEANS, NEB.—The Orleans Electric Light Company has been incorporated with a capital stock of $10,000. P.

WILLOW LAKES, S. D.—This city is installing an electric lighting system. Thomas & Felix are doing the work. P.

ELLENSBURG, WASH.—The fire and water committee will call for bids for the installation of a fire alarm system. C.

ELDORADO, TEX.—The Eldorado Water and Power Company has been incorporated with a capital stock of $20,000. P.

FREMONT, NEB.—The Fremont Electric Light Company has announced that it will spend $25,000 for improvements this year.

BROWNSVILLE, TEX.—This city will vote March 8 on the issuance of $15,000 in bonds for repairing the municipal electric light plant. P.

GRAND FORKS, N. D.—A vote will be taken February 14 on issuing bonds for $25,000 for improvements in the lighting system. C.

CAMDEN, S. C.—The property, franchise, etc., of the Camden Water, Light and Ice Company, has been sold to T. J. Kirkland. L.

COLUMBIA FALLS, MONT.—The Northern Idaho & Montana Power Company has been granted an electric light franchise here.

COLLINSVILLE, ILL.—The Citizens' Gas and Power Company has been incorporated with a capital of $25,000. The incorporators are: F. D. Moses, T. Fox and J. H. Siegel.

CRAB ORCHARD, NEB.—A company has been formed to take over the old electric lighting company, and new equipment will be installed. C.

MILES CITY, MONT.—E. L. Benson, representing eastern capitalists, proposes to purchase the electric light plant and install water power. C.

CROCKETT, TEX.—C. L. Edmiston has purchased the Citizens Ice and Light Company, and will spend $7,000 in improvements to the plant. P.

FARGO, N. D.—Owing to some irregularity in the call, the date for taking a vote on issuing $35,000 electric light bonds has been postponed to February 18. C.

TRIPP, S. D.—Philip Ehresmann sold the electric lighting plant and the telephone company to Dr. Sprecher and Emanuel Muller, of Parkston, for $15,000. C.

LONG PINE, NEB.—The new electric lighting system here has recently been put in operation. The plant was installed by S. H. Kyner, proprietor of the roller mills.

MINNEAPOLIS, MINN.—The Northwestern Electric Show association, Geo. J. Cadwell, secretary, will hold an exhibition in the armory building March 25 to April 2. C.

HULL, IOWA.—A franchise has been voted to Merkholtz & Strenfort, of Minneapolis, Minn., to operate an electric light plant in connection with a roller mill which they have established. C.

VIRGINIA, MINN.—The council has granted a franchise for the construction of a street railway to Eveleth and Gilbert, Minn. E. G. Chapman, of Chicago, and W. M. Prindle, of Duluth, are interested. C.

INDIANAPOLIS, IND.—The City Council and board of public work are planning to construct and equip an electric light and cold storage plant in the city market square. The estimated cost is $100,000. S.

COLLINSVILLE, ILL.—The Citizens' Gas and Power Company has been incorporated with a capital of $25,000 to operate a gas and electric plant. The incorporators are F. D. Moses, T. Fox and J. H. Siegel.

LINCOLN, NEB.—Roscoe C. Ozman, city clerk, will receive bids until February 24, for the installation, including concrete foundation, of a 750-horsepower engine at the Hutton lighting station. Estimated cost $21,835. C.

SEATTLE, WASH.—The Granite Lighting and Power Company has been incorporated with a capital stock of $500,000 by Harry H. Frost, James T. Hamilton, Cornelius Christopher, James H. Fox and Timothy J. O'Neil. A.

IDAHO FALLS, IDAHO.—The power plant, power site and business of the Idaho Power and Transportation Company have been sold to H. M. Byllesby Company, of Chicago. The amount paid was not made public.

TACOMA, WASH.—The city intends to make permanent the system of street lighting which was in operation during last summer. Geo. Gove, architect, will design wrought iron arches to span the principal streets. C.

HARTFORD, CONN.—The New Milford Electric Light Company has filed a certificate of its action in increasing its capital stock from $35,000 to $100,000. The new owners of the concern are carrying out plans for improvements and expansion.

RUSSELVILLE, ALA.—An electric light plant is soon to be installed here by George C. Thornton, president of the Russelville Manufacturing and Development Company and Mr. Moon of Gadsden. The franchise has already been granted.

LEWISTOWN, MONT.—John L. Bright has petitioned the city council that a vote may be taken on granting him a franchise to install and operate an electric light plant. If successful he will expend $200,000 in building and equipping a plant. C.

ANTWERP, N. Y.—The Antwerp Light and Power Company has been incorporated with a capital of $15,000 to furnish electricity for light, heat and power. The company was in corporated by J. A. Baumert, H. M. Baumert and P. Campbell, all of Antwerp.

GRAND RAPIDS, MICH.—The Commonwealth Power, Railway and Light Company, has issued $1,000,000 of preferred stock which has been taken in Grand Rapids and vicinity. The preferred stock has a present value of 88 and the common stock of 54.

VALDOSTA, GA.—G. W. Varn and the associates of the consolidated Ice and Power Company have purchased the Valdosta Ice and Manufacturing Company, and will operate its entire plant. The latter company recently received the contract for lighting the streets of Valdosta. B.

PLACERVILLE, CAL.—T. A. Murray has filed a notice of location and appropriation of 10,000 inches of water in Camp Creek, flowing into the North Fork of the Cosumnes River. The location is to be used for power, municipal, irrigation and also for mining purposes. A.

RED BLUFF, CAL.—The Rancho Buena Ventura, headed by George L. Hoxie, has filed a notice in the county recorder's office of an appropriation of 15,000 inches of water in Cotton Wood Creek. The water will be used for irrigating purposes and for generating electricity. A.

SHELBYVILLE, IND.—Plans are being made for the erection and equipment of a new combined water, light and gas plant in this city. The company is already operating plants in a number of Indiana cities and is composed of Ambrose Petty, of New York; Howard Olds, of Detroit; John T. Bacon, Chicago, and F. C. Kelley. S.

NORTH BALTIMORE, OHIO.—Negotiations are said to be under way, which if consummated will result in the turning over of the electric lighting plant at North Baltimore, Ohio, to Cleveland parties. The concern has not been financially prosperous under the present management. The council will be asked to grant a new franchise. The question of whether it shall be for fifteen years as designated by the city, or twenty-five years as asked by the company has held up the grant for some time. H.

TACOMA, WASH.—The contract between this city and the Seattle, Tacoma Power Company went into effect February 1. The company is to furnish 1,000 additional horsepower at peak load for $850 per month. The city was formerly using 8,500 to 9,000 horsepower.

LOS ANGELES, CAL.—The Pacific Light and Power Company has been reincorporated for $40,000,000, preliminary to a number of betterments, including the doubling of the capacity of the $1,750,000 plant at Redondo, Cal. More power will also be developed at Kern River. A.

FT. WAYNE, IND.—The Protective Electric Supply Company, of this city, has notified the Secretary of State that it has increased its capital stock from $10,000 to $25,000 for the purpose of enlarging its plant and business. Milton B. Larimier is president and E. M. Popp, secretary. S.

CRAWFORDSVILLE, IND.—A movement is on foot to erect and equip a new electric light and power plant in this city. The trustees in charge of the old plant have decided that a new plant would be advisable to attempt to improve and reequip the old plant. James R. Thomas is superintendent. S.

HOLLYWOOD, CAL.—Resolutions have been adopted recommending that the city make a contract with the Pacific Light and Power Company for installing a complete system of tungsten lamps. The old iron wires which were in use will be replaced by copper wires and the system considerably extended.

BESSEMER, ALA.—The Woodward Iron Company has finished installing its electrical haulage system on Red Mountain where the output daily from the Woodward Mines is 2500 tons. The electric haulage working at Mine No. 3 and accomplishing satisfactory results. This is the only electric system of its kind on Red Mountain. B.

LEWISTON, ME.—The Farmington Electric Light Company has sold its plant to the Franklin Light and Power Company, and the latter is now in control of the local plant as well as of the plant at Cleveland's Rips, New Portland, where a dam has been built and other work done preparatory to furnishing electric light and power.

WILSON, N. Y.—A proposition has been submitted to this village by the Newfane Electric Light Company whereby the company would light the village provided the board obtained 100 other subscribers for lights. This has been accepted and the village will be lighted by 125 lamps, and power will also be furnished to stores and homes.

TUSCALOOSA, ALA.—A special meeting of the Board of Trade was held at the court house for the purpose of discussing the advisability of the city purchasing the electric lighting plant of this place. The city has an option on the plant. The meeting developed ardent supporters for and against municipal ownership. The matter is still being talked of. B.

SHENENDOAH, PA.—The Shamokin and Coal Township Light Heat and Power Company has been permitted, by a special ordinance to turn over $1,620,000 in property to a New York syndicate. With the turning over of the plants, which includes the electric light and gas concerns, the new corporation will retain the present name, but a new list of directors and officers is to be elected.

FAYETTEVILLE, N. C.—The plant of the Fayetteville Gas and Electric Light Company was sold at auction on January 17 at Fayetteville and was bought in by Thomas Badger, Jr., for the sum of $11,000. The sale was made by order of the United States court. Mr. Badger has been manager of the company for sometime. H. H. Carr is commissioner for the bondholders who were also represented by Judge J. E. Shepherd, of Raleigh. L.

LOS ANGELES, CAL.—The Pacific Light and Power Company has been incorporated with a capital stock of $40,000,000. The incorporation was made because of the increase in the business of the Pacific Light and Power Company and the small capitalization which that company had. The directors of the new corporation are W. G. Kerckhoff, Kasper Kohn, Charles Farman, A. N. Kemp, Henry E. Huntington, George S. Patton and Howard E. Huntington.

TACOMA, WASH.—The first lumber mill on the Pacific Coast to be equipped throughout with electric motor drive is now being built at Union Mills near Lacey, twenty miles west of Tacoma by the Union Lumber Company. The entire equipment for this mill, both the electrical and saw mill machinery, is being furnished by Allis-Chalmers Company. Current will be generated by a 750-kilowatt, sixty-cycle, three-phase, alternator directly connected to a steam turbine.

TRINIDAD, COLO.—A mortgage has been filed by the Colorado Light and Power Company in favor of the Central Trust Company of New York. The property is mortgaged for $5,000,000. The money will be used in making improvements in Trinidad and vicinity and to this end machinery will immediately be ordered which will increase the capacity of the local plant from 1,400 to 15,000 horsepower. The current will also be extended to Walsenburg and surrounding coal camps.

FARIBAULT, MINN.—The new Faribault Electric Light Company which has secured the Cannon Falls property plans to extend a line to Red Wing, and also to Mankato to connect with the company there. The Mankato company has secured control of the Rapidan water power property and will develop a large amount of power. The line from Faribault will touch Morristown, Waterville, Elysian, Madison Lake and Eagle Lake, and these towns will be furnished power and light.

SAN JOSE, CAL.—The Sierra and San Francisco Power Company has brought suit against the Spring Valley Company, to obtain a right of way two miles long for a transmission line in the vicinity of Dumbarton Point. The Sierra Power Company has secured rights of way for fifty-foot steel poles at a distance of 800 feet apart through the territory from the generating plant in Tuolumne County, and all that is needed to bring the power into San Francisco is this two miles of land in question. A.

THOMASVILLE, N. C.—The announcement was made at the recent meeting of the Thomasville Light and Power Company that a controlling interest in the company had been purchased by Frank H. Fleer, the Philadelphia chewing gum manufacturer of national reputation, and F. W. Bryant, general manager of the plant at the present time. Mr. Fleer has been elected president; general manager, F. W. Bryant, and secretary and treasurer, J. C. Bryant. The company having unlimited capital behind it, it is stated that the plant and service at Thomasville will be built up to a high state of perfection. L.

REDDING, CAL.—The Mount Shasta Power Company, incorporated with a capital stock of $1,000,000 by John Coffee Hays, of Visalia, Cal., William A. Cooper of San Francisco, R. E. Johnson of San Francisco, H. V. Gates of Hillsboro, Ore., Jesse W. Lilienthal Albert Raymond and A. J. Treat of San Francisco, has filed its articles of incorporation here. The principal place of business of the corporation is in San Francisco and Shasta County is to be the field of operation. The big bend of the Pitt River, in which the company has a water right of 200,000 inches, makes a twenty-five-mile detour, and it is the intention of the company at an expense of several million dollars to dig a seven-mile tunnel through the mountains which will deliver the water with a fall sufficient to produce 250,000 horsepower. A.

CHARLOTTE, N. C.—The Charlotte Power Company, of which W. S. Lee, vice-president and general manager of the Southern Power Company, is president, has formally assumed charge of the city lighting and power business, taking power from the Southern Power Company in "wholesale lots" and "retailing" the same to the city, and to the large number of private interests and households that are served. The Charlotte Power Company, chartered in New Jersey and domesticated in North Carolina a few weeks ago, has an initial capital of $300,000 and is closely affiliated with the Southern Power Company. The new subsidiary concern has built up a large power business here, and is conducting a vigorous campaign to make popular the use of electricity not only for lighting, but for all of the industrial and household purposes to which it is adapted. L.

CHARLOTTE, N. C.—The last report of the commissioner of labor and printing shows that already twenty-six per cent of the 312 cotton mills of North Carolina are now using electricity solely as motive power. This revolution in the matter of motive power has been achieved practically within the last ten years, especially among the new mills, and probably sixty per cent of the existing mills have been completed during the ten-year period referred to. Furthermore it is found by comparison of figures that thirty-five per cent of the cotton manufacturing plants use electricity either entirely or in part, some of the mills making use of both steam and the electric drive. The indications are that this percentage will gradually increase—will increase rapidly during the next few years, until practically every up-to-date mill in the south will be electrically driven, unless it is so situated that direct waterpower, or the inaccessibility of the electric current, will prevent the change. L.

CHARLOTTE, N. C.—J. B. Duke, one of the largest stockholders in the Southern Power Company, and whose name is closely allied with the American Tobacco Company interests, has been placed on the board of directors of the American Trust Company, of Charlotte. Mr. Duke has extensive interests in this section by reason of his large holdings in the Southern Power Company, and his acceptance of a place on the directorate of the trust company, is regarded as being of considerable significance, relative to the electrical development of this territory. It has been surmised that the newly promoted American Guarantee Company, formed to lend financial assistance to cotton mills and other manufactories, will receive much of its material support from the American Trust Company, so that Mr. Duke's assuming a position as director of the trust company is seen to be logically in line with the purposes and objects of the American Guarantee Company, and the trust company with which it is believed the guarantee company will be allied. L.

ELECTRIC RAILWAYS.

(Special Correspondence.)

EVELETH, MINN.—A franchise for an electric car system was granted to Mr. Prindle and others.

ANACORTES, WASH.—The council granted a franchise to the Baker River & Puget Sound Railway. C.

CLARINDA, IOWA.—A five per cent tax for the construction of the Iowa & Southwestern Railroad has been voted. C.

LEON, IOWA.—Smith & Johnston, of the Leon Electric Company, are promoting the construction of a street car line from the Burlington station to the city. C.

SIOUX CITY, IOWA.—C. A. Magee, of Pittsbhrg, Pa., seeks a franchise here for an electric interurban which is proposed to be built from Parkston, S. D., to this city. C.

SAN FRANCISCO, CAL.—The United Railways has secured a franchise for a term of twenty-five years over Gough Street and McAllister to Market and Haight Streets.

MINNEAPOLIS, MINN.—The Dan Patch Line has ordered 4,000 tons of rails and steel cars and proposes laying the track from Minneapolis to Northfield, Minn., forty-five miles, as soon as this is possible. C.

DECATUR, ILL.—The Decatur Southern Traction Company has been incorporated to operate an electric railroad from Decatur to Pana. The incorporators are William S. Carter, George H. Winsor and Henry B. Davis.

PLYMOUTH, IND.—L. M. McCampbell, chief promoter of the South Bend and Logansport Traction Company, announces that he has contracted for 50,000 ties for February delivery, and that 300 teams have been hired to finish the work of construction. S.

JONESBORO, IND.—The Indiana Union Traction Company's bridge at this point over the Mississinewa River has been swept away by an ice gorge. Passengers will have to transfer at this point for several weeks or until a new bridge is constructed. S.

DAVENPORT, IOWA.—The Rock River Traction Company states that contracts have been let for the construction of an interurban line from Sterling, Ill., to this city, sixty-two miles, for $1,240,000. The Northwestern Construction Company, of Milwaukee, has the contract. C.

JOHNSTOWN, PA.—A company with $500,000 capital is being formed in Johnstown for the purpose of leasing the Johnstown Passenger Railroad Company, control of which was secured recently by the American Railway Company through the purchase of the stock of T. C. du Pont.

GUTHRIE CENTER, IOWA.—The Guthrie Center Commercial League is trying to secure the construction by the Railway Promotion Construction Company, of Des Moines, of an electric line to Des Moines, via Redfield, Adel, Dallas Center and Grimes. The estimated cost is $27,000 a mile. C.

LOS ANGELES, CAL.—The Pacific Electric Railway has completed its lines through Claremont and rails are now being laid connecting that city with Upland. As soon as the right of way has been secured the company will rush the completion of the line through Pomona and to Covina. A.

INDIANAPOLIS, IND.—According to the December report of H. J. Milligan, receiver for the Indianapolis, Crawfordsville & Western Traction Company, the total earnings amounted to $13,274.68. The operating expenses were $8,789.52, making the net earnings for the month $4,485.16. S.

SAN JOSE, CAL.—The stockholders of the San Jose Railway, the corporation which recently merged most of the street railways in the city, has issued bonds to the amount of $1,500,000. The First Street line will be entirely reconstructed and the entire system will be extended and improved. A.

COLUMBUS, IND.—The annual meeting of the stockholders of the Indianapolis, Columbus and Southern Traction Company was held in this city January 19. The old board of directors was re-elected and the directors in turn elected the following officers: President, Joseph I. Irwin; vice-president, William G. Irwin; secretary-treasurer, Hugh Th. Miller; general manager, A. A. Anderson. S

NEW YORK, N. Y.—The New York Public Service Commission on February 9 will give a hearing to the Manhattan Bridge Three-Cent Line for a certificate of public convenience and necessity for the construction of a street surface railroad from Brooklyn across the Manhattan Bridge and through Canal street to the Hudson River, Borough of Manhattan, New York city. Commissioner Bassett will preside.

TOLEDO, OHIO.—The subsidiary lines of the Toledo Railways & Light Company, have organized with the election of the following officers: President, John F. Collins; vice-president, William F. Nutt; secretary, E. R. Effler; treasurer, H. S. Swift; directors, J. F. Collins, W. F. Nutt, C. C. Wening, A. J. Lamb and E. R. Effler. J. F. Collins, who has been made head of the Toledo & Western, is also head of the Toledo, Ottawa Beach & Northern, the Toledo Beach line, and will have charge of the Maumee Valley Railway and Light Company H.

TOLEDO, OHIO.—The Toledo & Indiana Electric Railway has been sold by Receiver Niles, at $52,500 more than the former sale which the court refused to confirm. S. C. Schenk, of Toledo representing the majority bondholders was the purchaser, for $1,058,500. The minority stockholders were the successful bidders at the last sale. It is estimated that they will receive about sixty-four for their holdings under the last sale. There is a rumor that the road may be turned over to the Ohio Electric. In the meantime the majority bondholders will operate the road. H.

ATLANTA, GA.—The stockholders of the Georgia Railway and Electric Company were informed by President P. S. Arkwright that 50,570,953 passengers were handled on the company's lines during 1909, and over 45,000,000 during the year preceding, and that not one passenger was killed or seriously hurt during that period. The stockholders re-elected the old board of directors and the latter were scheduled to meet on February 1, to elect officers for the year. All of the reports of the various departments of the company were excellent, and showed that the company was in fine shape financially, with an optimistic outlook for the immediate future. L.

PHILADELPHIA, PA.—Judge Holland in the United States Circuit Court has directed the receivers of the Holmesburg, Tacony &Frankford Electric Railway Company to sell all the property, franchises, machinery and equipment of the company at public sale. In the decree the receivers are instructed that no bid under $350,000 shall be accepted, and those who bid over this amount shall be required to deposit $25,000 to make good their bid. The order of Court directing the sale grows out of proceedings begun sometime ago by a committee of first mortgage bondholders to secure the interest which had accrued on their holdings. On November 11 last Samuel Crother, Jr., Henry Bain and William N. Trinkle were appointed receivers and ordered to continue the business of the company. C

COLUMBIA, S. C.—The Greenville, Spartanburg and Anderson Traction Company has been formally commissioned by the secretary of state at Columbia, the capital being $300,000 to begin with. This is the recently reported extensive interurban electrical development proposed by the Duke interests, with numerous local capitalists, including Capt. Ellison A. Smythe, Lewis W. Parker, and others. The line will run from Anderson to Greenville to Spartanburg, and the power will be drawn from the lines of the Southern Power Company. The ultimate purpose of the corporation it is believed, is to extend north through North Carolina to Charlotte, Salisbury, High Point and Greenville. The line already incorporated will pass through numerous cotton mill towns in South Carolina, where a large freight and passenger traffic is anticipated for the electric railway. L.

GASTONIA, N. C.—The Piedmont Traction Company has received its charter from the secretary of state, ths company having been formed to build an electric line in Gastonia, and to extend the same to Mt. Holly, a manufacturing town fifteen miles north. W. S. Lee, vice president of the Southern Power Company, of Charlotte, and C. E. Hutchison, cotton manufacturer of Mt. Holly, are interested. Preliminary work on the lines in Gastonia was begun some tme ago, and the line surveyed to Mt. Holly. Contracts for grading this fifteen-mile stretch will probably be let within the near future. This development is a part of the general plan of the interests closely connected with the Southern Power Company, to put in an extensive system of interurban electric lines, the most extensive portion of which work has been projected between Anderson, Greenville and Spartanburg, S. C. L.

ROCKINGHAM, N. C.—It is announced that the fight of many months between conflicting interests in the Rockingham Power Company, has been brought to a final end, and that the way is now prepared for the completion of the large development which was started some years ago. The interests of the entire undertaking, together with all lands, etc., have been placed in the hands of the reorganization committee, and the committee is engaged at the present time in working out a definite plan for financing the proposition to a successful conclusion. While the sum of nearly $2,000,000 has been already expended on the development at Blewitt's Falls, it is said that an equal amount will be needed to complete the work. The lands concerning which there has been so much litigation, and which were held by Hugh MacRae and Company, are also included in those which have been deeded to the reorganization committee. L.

TRENTON, N. J.—The Mount Holly Safe Deposit and Trust Company, as trustee, has filed a bill in the Court of Chancery to foreclose a mortgage given by the Burlington County Railway Company to secure an issue of $550,000 general mortgage five per cent gold bonds. The mortgage covers all of the property of the company, whose line extends from Stanwick to Burlington City by way of Mt. Holly. The bill shows that the company defaulted in the payment of interest on September 1, 1909, and that the holders of $254,000 worth of bonds have vested in I. Snowden Haines, of Burlington; Samuel A. Atkinson, of Mount Holly, and William W. Stokes, all the necessary power to protect the interests of the bondholders. The holders of $213,000 worth of bonds have vested the same powers in A. Merritt Taylor. Judge John G. Horner was appointed receiver of the company last August and has since been operating the road. At the time of his appointment it was alleged that the company was insolvent.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

SYLVIA, KAS.—The Sylvia Telephone Company has been organized by J. T. Scott and others. P.

HARTLEY, IA.—Sauer's Telephone Company has been incorporated with a capital stock of $10,000. P.

ABERDEEN, WASH.—The Pacific Telephone and Telegraph Company will install a new switchboard. C.

PARK RIVER, N. D.—The Park River Telephone Company will enlarge and improve its system in the spring. C.

COLD SPRING, MINN.—The Minnesota Central Telephone Company will extend its lines to Rockville, Minn. C.

LONE ROCK, WIS.—The Lone Rock Telephone Company has increased its capital stock from $1,500 to $3,000. P.

VALLIANT, OKLA.—The Big Ten Telephone Company has been incorporated with a capital stock of $5,000. P.

PRAIRIE, IOWA.—Robert Parker sold his telephone interests here and purchased a telephone property in Texas. C.

CORINTH, IOWA—In the spring the Hancock County Rural Telephone Company will build a toll line to Britt, Iowa. C.

LEMMON, S. D.—The Lemmon Home Telephone and Telegraph Company expects to extend its lines during the coming year. C.

DEL RIO, TEX.—The Del Rio & Western Telephone Company has increased its capital stock from $60,000 to $80,000. P.

PONCA, OKLA.—The Bois de Arc Valley Telephone Company has been incorporated with a capital stock of $6,000. P.

TWIN BRIDGES, MONT.—The Montana Independent Telephone Company has asked admission to the city for its wires. C.

GRACEMONT, OKLA.—The Gracemont & Oney Telephone Company has been incorporated, by T. M. Franklin and others. P.

TINTAH, MINN.—The Tintah Telephone Company, N. F. Doleman, secretary, has been incorporated with a capital of $10,000. C.

MAYNARD, MINN.—F. E. Nelson, Martin Dahleen and others are behind a project to extend the rural telephone lines west of here. C.

CANADIAN, TEX.—The Canadian Long Distance Telephone Company will extend its toll lines to Amarillo, Tex., and Eastern, Okla. P.

BROWNTOWN, WIS.—The Browntown Telephone Company has increased its capital stock from $5,500 to $19,800. P.

CULBERTSON, MONT.—The Montana Star Telephone Company will commence construction on the line across the reservation April 1. C.

NEENAH, WIS.—The Clayton Telephone Company has been organized to build a line connecting with the Wisconsin Telephone Company. C.

HANCOCK, MICH.—The Michigan State Telephone Company plans the construction of five new trunk lines to Calumet and two to Lake Linden. C.

MILLVILLE, IOWA.—Geo. Friedman, John A. Smith and others have incorporated the Millville Farmers Telephone Company with a capital of $9,900. C.

MARSHALL, MINN.—The Northwestern Telephone Exchange Company will rebuild its exchange and make other improvements aggregating $23,000. C.

NEW RICHMOND, WIS.—A meeting has been held to organize a local independent telephone company and install a modern plant at a cost of $15,000. C.

KAUKAUNA, WIS.—The Kaukauna Telephone Company has commenced the construction of a system of lines extending into the country around this city. C.

DILLON, MONT.—The Bell Telephone Company is installing a new switchboard, sufficiently large to take care of the company's business for the next five years. C.

EAU CLAIRE, WIS.—The Eau Claire County Telephone Company has increased its capital to $10,000 to extend its system in Eau Claire and Chippewa counties. C.

DEER RIVER, MINN.—M. L. Smith was granted a franchise to install a telephone exchange in Deer River, Minn. The line will probably be magneto Bell with toll connections.

PIERRE, S. D.—The telephone company expects to spend a large sum of money this coming summer in improvements and extensions and may install an automatic exchange. C.

SAUK CENTER, MINN.—The council voted to grant a new franchise to the Northwestern Telephone Exchange Company. The company expects to rebuild its system at a cost of $15,000. C.

ROBESON COUNTY, N. C.—The Farmers' Rural Telephone Company, with $6,000 capital, has been chartered in this county in Smith's township, by D. V. Walker, W. G. McLean and others. L.

WINNEMUCCA, NEV.—J. E. Webb, of the Golconda Telephone, Light and Power Company, with F. Murray, has completed arrangements for installing a switchboard and a local telephone system here.

PORTLAND, ME.—The North Atlantic Wireless Telegraph and Telephone Company has been incorporated with a capital of $500,000. The president is H. W. Fairbanks, and the treasurer, H. T. Waterhouse, Portland.

TROY, MONT.—D. T. Wood has applied for a franchise for the Fall River Telephone Company to take over the Bull Lake Telephone Company. The system will be extended to Sylvanite, Libby and other places. C.

BURNS, ORE.—The Union Telephone and Telegraph Company, with principal office at Burns, Ore., has been incorporated with a capital stock of $5,000 by J. H. Jordan, John Jenkins, C. E. Voegtly and L. E. Laurance.

HUNTINGTON, W. VA.—The Southern Bell Telephone Company has secured a majority of the stock and purchased all of the bonds of the Huntington Mutual Telephone Company and the latter will be absorbed.

ELLIOTT, IOWA.—The Elliott Mutual Central Telephone association had decided to incorporate, at its annual meeting. H. S. Leonard was elected president; O. J. Powell, secretary, and E. H. Vancshoiack, treasurer. C.

ELDORADO, TEX.—A. P. Bailey of Ozona, Tex., has purchased the telephone exchange at El Dorado from B. E. Earle. The consideration was $9,000. The new owner will make important extensions and improvements D.

MODESTO, CAL.—The Ceres Telephone Company contemplates beginning work in a few days on the extension of its system toward the Crows Landing Road Country. It is said this extension will include five miles of wiring.

SHELLMAN, GA.—The Shellman Telephone Company has been incorporated with $5,000 capital stock by W. T. Jay, T. R. Arthur, C. W. Martin, W. T. Jay & Company, H. O. Crittenden and others for the purpose of establishing a modern telephone system at Shellman. B.

DICKINSON, N. D.—The North Dakota Independent Telephone Company, of Fargo, purchased the telephone system from Hughes & Deiters and will erect a one-story brick building, with basement and will install a central energy system and an overhead cable system. C.

PINE RIVER, MINN.—The Pine River Rural Telephone Company will construct a line about thirty miles long to the Poplar-Hazel Dell country; another about twenty miles long from Emily to Little Pine, and possibly a third to connect Swanburg with Longville. C.

ARGENTA, ILL.—The Argenta Telephone and Electric Service Company has been incorporated to operate a telephone system and an electric generating plant. The incorporators are Samuel Gerber, Peter E. Gerber and Samuel O. Hillbrant. The company is capitalized at $20,000.

TYNER, N. C.—A charter has been granted to the Chowan Telephone Company, of Tyner, Chowan county, N. C., with $10,000 authorized capital, to construct and operate a telephone system. T. C. White, Edenton, N. C., Dr. J. R. Parker, of Tyner, and others are interested. L.

EAST GRAND FORKS, MINN.—Farmers in Sullivan and Grand Forks townships, northeast of here, have organized the Grand Marais Telephone Company with Iver M. Johnson, secretary and treasurer, to construct a line to connect with the Northwestern Telephone Exchange Company's line. C.

DALLAS, TEXAS.—It is stated by C. A. Gates, superintendent of construction for the Southwestern Telegraph and Telephone Company in Texas, that that company has adopted plans for the expenditure of nearly two million dollars in improvements and enlargement of its system in this state during the present year. It is a Bell concern. D.

MEXICO CITY, MEXICO.—The Mexican government is gradually extending its wireless telegraph system. It now has four stations in operation upon the shore of the Gulf of California. Two stations have been established in the remote territory of Quintana Roo, one at Xcalax and the other at Payo Obispo. The German "Telefunken" system is used. The service will be considerably enlarged during the present year. D.

GUANAJUATO, MEXICO.—A syndicate composed of George W. Bryant, Jose Bustamente and Nemecio Ponce, all of Guanajuato, has obtained a concession from the government of this state for the construction of an extensive system of telephone lines in this state, and the establishment of local exchanges in Guanajuato and other towns. D.

LEXINGTON, S. C.—During the past few weeks several rural telephone lines have been built out into the surrounding county, and during the past year about 100 phones have been connected in this way with the Citizens Exchange of Lexington. The extension of trunk lines into the county sections is proving very popular with the farmers everywhere, and this line of development promises great things for the telephone people in the immediate future. These lines are all capable of connecting with the long distance service of the Southern Bell Telephone Company, putting the farmers in direct communication with the entire country. L.

ELECTRICAL SECURITIES.

The erratic fluctuations which have been a feature of the stock market for the past few weeks have at last been quieted. It seems now that there is certain to be a slow, steady improvement in prices for a few weeks at least before there is any sudden upward movement. So much has been talked of in political circles that it seems assured that nothing will be done. Even while the dissolution of trusts is being agitated their securities are on a firmer basis than ever before.

The subscriptions to the $5,000,000 Western Electric five per cent bonds totaled over $16,000,000.

The annual meeting of Washington Water Power Company will be held in Spokane on February 7. Books close January 31 and reopen February 8.

Chicago Telephone annual meeting will be held February 9.

The annual meeting of the New York Edison Company will take place February 8.

The Lynn Gas and Electric Company has petitioned the Massachusetts Gas Commissioners for authorty to issue $150,000 additional capital stock at $235 per share for additions to the plant.

The Great Barrington Electric Light Company has petitioned the Massachusetts Gas Commission for approval of issue of $80,000 new stock at $100 per share, for the acquisition of water and real estate.

At the annual meeting of the United Railways of St. Louis, W. J. Kinsella was elected a director to succeed C. W. Wetmore. Other directors were re-elected.

The Great Barrington Electric Light Company has asked the Massachusetts Gas Commissioners for authority to issue $80,000 additional capital stock to be offered to stockholders at $100 a share. The proceeds are to be used to fund the floating indebtedness of the company.

The Consolidated Traction Company reorganization committee will allow deposits of underlying securities for participation in the reorganization plan betwen February 1 and March 1, with the Harris Trust Company and the Central Trust Company, of New York.

Kings County Electric Light and Power Company is authorized by the New York Public Service Commission to issue $2,500,000 convertible debenture six per cent bonds. Although an issue of $5,000,000 was applied for, the Commission decided that only one-half that amount is necessary to go ahead with improvements at this time.

At the annual meeting of the Brooklyn Rapid Transit Company two new directors were elected, Bernard Gallagher to succeed the late E. H. Harriman, and C. D. Meneely, to succeed the late William Seibert. Mr. Meneely is secretary and treasurer of the company. The retiring memers of the board were re-elected.

Proceeds of the sale of $6,000,000 Chicago Railways' first mortgage bonds will be used for new equipment and completing the Washington and La Salle Street tunnels. During the past year the company spent the proceeds from $11,000,000 bonds in rehabilitation work. The new issue will take care of the unfinished work, making a total of $25,000,000 spent in rehabilitation under the partnership ordinance. The Chicago City Railway has outstanding $22,500,000 similar bonds. The average price of all these traction issues has been close to par for both companies.

DIVIDENDS.

American Telegraph and Cable; one and one-quarter per cent, payable March 1.

Charlestown Gas and Electric Company; quarterly dividend of $2.50 per share, payable February 1, to stockholders of record January 18.

Connecticut Railway and Light Company; quarterly dividend of one per cent, payable February 15, to stockholders of record February 1.

Electric Properties, preferred quarterly dividend of one and one-half per cent, payable February 10.

Hartford Electric Light Company; voted to increase the quarterly dividend to two and one-half per cent, an increase of one-half of one per cent. The half per cent has been paid as an extra dividend for the past two quarters. The dividend is payable February 1 to stockholders of record January 26.

Ohio Traction Company; quarterly dividend of one and one-quarter per cent on its preferred stock, payable February 1.

Philadelphia Electric Company; directors approved a stock dividend of $1.50 per share to be credited on the stock, making it $15 paid.

NEW YORK.

	Jan. 31.	Jan. 24.
Allis-Chalmers common	12½	13¼
Allis-Chalmers preferred	42	47
Amalgamated Copper	82	83⅝
American Tel. & Cable	*80	*80
American Tel. & Tel.	137	137¾
Brooklyn Rapid Transit	72⅞	74
General Electric	152½	155¾
Interborough-Metropolitan common	21⅝	22⅝
Interborough-Metropolitan preferred	56	58
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	88¾	89
Mackay Companies (Postal Telegraph and Cables) preferred	77½	77
Manhattan Elevated	136	137¼
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	84	86¾
U. S. Steel preferred	123½	124
Western Union	71	73⅛
Westinghouse common	71	74
Westinghouse preferred	125	130

BOSTON.

	Jan. 31.	Jan. 24.
American Tel. & Tel.	137	137¾
Edison Elec. Illuminating	242	242
General Electric	155	155¾
Massachusetts Electric common	19	18¾
Massachusetts Electric preferred	81	81
New England Telephone	134	135
Western Tel. & Tel. common	15	16
Western Tel. & Tel. preferred	89	90

PHILADELPHIA.

	Jan. 31.	Jan. 24.
American Railways	47⅞	48
Electric Company of America	12	11⅜
Electric Storage Battery common	58½	60½
Electric Storage Battery preferred	58½	60½
Philadelphia Electric	14	13⅞
Philadelphia Rapid Transit	26¼	26
Philadelphia Traction	88½	88
Union Traction	51	51

CHICAGO.

	Jan. 31.	Jan. 24.
Chicago Railways, Series 1	107	107
Chicago Railways, Series 2	29½	30
Chicago Subway	3½	4½
Chicago Telephone	127½	129
Commonwealth Edison	115½	117
Metropolitan Elevated common	15½	15½
Metropolitan Elevated preferred	54	54
National Carbon common	107	107½
National Carbon preferred	118	118

PERSONAL MENTION.

ALEX H. BOYD, electrical engineer for the Ft. Wayne Electric Company, has been made manager of the company's branch at Philadelphia.

DR. SHELFORD BIDWELL, F. R. S., of Weybridge, Eng., known for his researches in electricity and optics, died a short time ago at the age of seventy-one years.

B. J. NICKLES, a prominent electrician of Madison, Wis., was elected vice-president of the Wisconsin Electrican Contractors' association at its state convention in Milwaukee last week.

JOHN N. CARLISLE, of Watertown, N. Y., has been nominated by Governor Hughes to be a member of the Public Service Commission of the Second District, to fill the vacancy caused by the resignation of Thomas M. Osborne.

J. A. GORDON, formerly superintendent of the Tipton Telephone Company, of Tipton, Ind., has been made superintendent and general manager of the Lafayette Telephone Company. Mr. Gordon will endeavor to improve the system and build up the service in every way.

R. L. RAND, manager of the Anniston Electric and Gas Company has been elected general manager of the Alabama Power Development Company. The company is engaged in the development of power at Jackson Shoals and proposes to transmit it to Talladega and Anniston.

GEORGE WESTINGHOUSE has recently been granted a leave of absence for six months by the board of directors of the company. Mr. Westinghouse will spend a part of his time abroad. The great amount of work that fell on him during and succeeding the receivership of the Westinghouse company has made this rest a necessity.

PROF. JAMES HOFFMAN, in charge of the heating and ventilating in the Engraving School at Purdue University, has been elected president of the American Society of Heating and Ventilating Engineers which was recently in session in New York. Prof. Hoffman is the author of a valuable book on the subject of heating and ventilating.

EDWARD B. RICHARDSON and RICHARD K. HALE have formed a partnership under the firm name of Richardson & Hale, consulting engineers and have opened an office at 85 Water Street, Boston, Mass. Mr. Richardson was formerly assistant engineer with Hollis French and Allen Hubbard, consulting engineers. Mr. Hale was formerly assistant engineer with Robert Metcalf and Eddy, consulting engineers.

F. A. HALL, who for the past twelve years has been manager of the chain block and hoist department of the Yale & Towne Manufacturing Company, of New York, N. Y., and Stamford, Conn., has resigned his position in order to accept election as vice-president and treasurer of the Cameron Enginering Company, of Brooklyn, N. Y. Mr. Hall's successor will be R. T. Hodgkins, who for several years has been his chief assistant. In his new connection Mr. Hall expects to make a specialty of trolleys and appliances for overhead handling of materials, and in connection therewith to make use of the Yale & Towne blocks and hoists, with the sale of which he has so long and prominently been identified.

PROPOSALS.

POST OFFICE, PAWTUCKET, R. I.—Notice has been given by the Supervising Architect that the time for opening bids for the extension, remodeling, etc., (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Pawtucket, Rhode Island, has been extended from January 25 to February 21.

POST OFFICE, GOLDSBORO, N. C.—Notice has been given by the office of the Supervising Architect that the time for opening bids for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of an extension to the United States Post Office at Goldsboro, North Carolina, has been extended from January 31 to February 25.

POST OFFICE, MERIDIAN, MISS.—Notice has been given by the Supervising Architect, Washington, D. C., that the time for opening bids for the extension, remodeling, etc., (including plumbing, gas piping, heating apparatus, electric conduits and wiring and standard clock system), of the United States Post Office and Court House, Meridian, Miss., has been extended from February 8, to March 2.

ADDITION TO LIGHTING PLANT, LINCOLN, NEB.—Sealed bids will be received at the office of the city clerk, up to February 18, 1910, for the erection and construction of an addition to the lighting plant of the city of Lincoln, in accordance with the plan, specifications and detailed drawings now on file in the office of the city engineer. The city engineer's estimate of the cost of this improvement is $5,330.00.

POST OFFICE, ATHENS, GA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until March 9, for the extension, remodeling, etc., (including plumbing, gas piping, heating apparatus, electric wiring and conduits), of the United States Post Office and Court House at Athens, Georgia, in accordance with the drawings and specifications, copies of which may be had from the custodian at Athens, Ga., or at the Supervising Architect's office.

POST OFFICE, SACRAMENTO, CAL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until March 24, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring and standard clock system) of an extension, remodeling, etc., to the United States Post Office and Court House at Sacramento, Cal., in accordance with drawings and specification, copies of which may be obtained from the custodian at Sacramento, Cal., or at the Supervising Architect's office.

WIRING AND MACHINERY FOR FORT BAYARD, N. M.—Sealed proposals (in triplicate) will be received until February 15, for the complete construction, plumbing, heating, electric light wiring, and electric light fixtures for one double set of hospital sergeants' quarters and one power plant with machinery for refrigerating and electric lighting systems at this post. Information will be furnished on application. Envelopes containing proposals should be marked "Proposals for Public Buildings," and addressed to Capt. S. P. Vestal, Constructing Q. M. A deposit of $10 will be required of intending bidders to guarantee the return of plans and specifications.

NEW INCORPORATIONS.

TOPPENISH, WASH.—The Submerged Power Wheel Company has been incorporated with a capital stock of $50,000 by W. B Campbell, William Simons and J. O. Hunter. A.

NEW YORK, N. Y.—The Peninsula Electric Company has been incorporated with a capital of $50,000 by E. O. Walton, Iron Hill, Ind., and T. Gibb and J. W. Hussey of Philadelphia, Pa.

CHICAGO, ILL.—The Safety Appliances and Equipment Company has been incorporated, with a capital of $5,000, to deal in electrical goods. The incorporators are: Paul Larmer, Edmund T. Kelly and Chas. E. Heckler.

POUGHKEEPSIE, N. Y.—The Bullock Safety Appliance Company has been incorporated to manufacture and deal in electrical supplies, particularly electrical alarm and signal apparatus. The capital is $5,000, and the incorporators are : P. H. Troy, Poughkeepsie; H. F. White, New York City, and J. S. McClellan, Albany.

GREEN, HOOK & COMPANY is the name of a new firm which has been incorporated to manufacture and compound chemicals for boiler treatment. Its main office is in the Hudson Terminal Building, New York. The main laboratory and works are in Jersey City, N. J., and another is under construction in Baltimore. The company is backed by Jacob W. Hook, president Old Town National Bank, and owner of Jacob W. Hook & Company, and C. Howard Hook & Company, manufacturers and dealers in oils, greases, etc., of Baltimore, and Stanley K. Green of New York.

INDUSTRIAL ITEMS.

J. B. TAYLOR AND COMPANY, engneers and contractors, have recently moved their office from the Hudson Terminal Building at 30 Church Street, New York City, to 37 Liberty Street.

THE W. N. BEST AMERICAN CALORIFIC COMPANY has retired from business and W. N. Best is now personally looking after the manufacture of oil and lard burners as well as regulating cocks and types of furnaces of which he is the inventor.

THE CENTRAL STATION DEVELOPMENT COMPANY, Cleveland, Ohio, which, as announced in the issue of January 8, 1910, has been incorporated to work in harmony with the various central stations in order to develop their commercial departments will have offices in Cleveland, Ohio, at the corner of Euclid avenue and East 9th street.

THE WESTERN ELECTRIC COMPANY has just received from the press bulletin No. 5270, describing its type T transformers. This bulletin is well illustrated, showing the features of design and construction. The descriptive matter gives complete information concerning the different essential parts. A copy of the bulletin will be mailed to any address.

THE MIANUS MOTOR WORKS, of Connecticut, has been authorized to carry on business in the state of Virginia, and A. L. Fairbanks. of Norfolk, has been given power of attorney as the company's representative, the company's object being the manufacture of motors, engines, etc., and the sale of the same, the capital named in the charter being $100,000 maximum. L.

THE McDONALD COMPANY, 617 Lissner Building, Los Angeles, Cal., manufacturers of reinforced concrete products, is distributing a booklet devoted to reinforced concrete ties. A number of photographs of typical installations are reproduced and in addition testimonials from firms who have them installed. McDonald trolley wheels are also described.

THE F. BISSELL COMPANY of Toledo, Ohio, has purchased an entire city block. A contract will be awarded at once for the erection of a large warehouse for the storage of bulky merchandise. In the spring a machine shop and other buildings will be erected, for the handling of dynamos, motors, electric switch boards and other telephone supplies. The company has a capital stock of $250,000.

THE H. W. JOHNS-MANVILLE COMPANY, Cleveland, Ohio, manufacturers of asbestos products, to keep the engineering public in touch with the development of the asbestos packing industry has founded a house organ which is to be called "The J.-M. Packing Expert." The first issue of this publication is now being distributed and contains much of interest. Copies will be distributed monthly hereafter.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has recently installed a producer-gas electrical generating plant for the Palmetto Phosphate Company at Tiger Bay, Florida. The plant consists of one 100-horsepower and three tandem gas engines each direct connected to a 200-kilowatt, 2,300-volt electric generator. A large number of motors as well as the necessary exciters, transformers, switchboards, etc., have also been installed so that the entire plant is electrically operated.

THE ROME WIRE COMPANY, Rome, N. Y., successors to the Wire and Telephone Company of America, manufacturer of bare and insulated wires, is distributing an attractive post card containing a reproduction of a photograph and a calendar for the month of February. This company is also sending out a folder containing the monthly average price of copper from 1883 to 1909. This folder also contains a list of products of the well-known "Romeoid" brand manufactured by the company.

ARTHUR S. LELAND & COMPANY, 40 Exchange Place, N. Y., are distributing, to interested parties, a booklet containing much valuable data concerning stocks and bonds. The companies listed are arranged alphabetically, and the par value of stock, amount of outstanding stock and dates of payment of dividend of each are shown. The booklet also contains an income table showing what securities will pay at a certain price, at different rates of interest. Copies of this booklet may be obtained from them on request.

THE CHICAGO FUSE WIRE AND MANUFACTURING COMPANY, Chicago, Ill., manufacturers of fuse protecting material, is distributing catalogue No. 24, which contains a complete list of enclosed fuses, National Electrical Code blocks and fittings, open fuse links, tested fuse wire and telephone fuses and blocks, all of the well known "Union" brand. In this catalogue are shown a number of protectors with and without lightning arresters, for protection to telephone, telegraph and fire alarm circuits, also a line of standard telephone cut-outs and protectors with fuses.

THE WESTERN ELECTRIC COMPANY, Chicago and New York, is distributing a little booklet describing and illustrating how lead-covered telephone cable is made at its great Hawthorne works. The cable plant at these works has a capacity for turning out 200,000,000 conductor feet in lead-covered cable every week, which makes it the largest plant of its kind in the world. This booklet contains a number of views in this well-equipped plant. besides one of a 600-pair cable and two that shows effectively the value of using cable instead of exposed aerial telephone wires.

THE LORD ELECTRIC COMPANY, of New York city, has just received an order for the complete equipment of all the electric street cars of the Electric Railway Company, of Saratoga and San Bernardo, Clute, with Earll retrievers. A comparative test of various retrievers was first made, as the result of which the city engineer of Saratoga recommended that Earll retrievers be insisted on. It was found that these machines operated not only satisfactorily but so easily that the strength of a man was not necessary, which was an important advantage because the cars are in charge of female conductors.

I. P. FRINK, manufacturer and designer of reflectors and lighting specialties, announces that over seventy Frink special tungsten clusters have just been installed in the Chicago headquarters of Hart, Schaffner & Marx, and over 100 in the Fifth avenue store of Franklin Simon & Company, New York city. Frink's special bronze reflectors for lighting the desks and screens of banks are also meeting with success. They have recently been placed in the Old Colony Trust Company, Boston, Mass.; New England National Bank, Kansas City, Mo., and the Mechanics-American Bank, St. Louis, Mo. Their St. Louis office is in the Bank of Commerce Building.

THE MINERALLAC ELECTRIC COMPANY, Chicago, Ill., announce the removal of its offices from 839-40 Monadnock Block to its factory, 1004-6 W. Van Buren Street, following the consolidation of the Chicago Electric Meter Company and the Minerallac Company under the new firm name Minerallac Electric Company. It intends issuing bulletins shortly on the new type of Chicago Printing Attachment which may be attached to any integrating wattmeter by the customer on their own premises, and which prints on a paper tape the actual amount of current consumed during any interval from fifteen to sixty minutes. It also announces an increase in the sale of high tension insulating compounds for use on underground work.

THE PIERCE PHOSPHATE COMPANY is installing a 1150-horsepower gas-engine-driven alternator set in its new generating station at Pierce, Fla., to serve as an auxiliary to the old power plant. The new equipment consists of a Westinghouse single-crank horizontal gas engine, direct-connected to a 856-kilovolt-ampere Westinghouse generator supplying three-phase current at 2300 volts for hydraulic mining work. The engine is furnished with fuel gas from double-zone producers. The new addition to the power plant equipment represents an expenditure of about $75,000, and will operate in parallel with the old station that was built some six years ago and which contains six 200-horsepower Diesel gas engines driving 150-kilowatt alternators.

THE ELMER P. MORRIS COMPANY, 90 West Street, New York, N. Y., manufacturers of ornamental poles and street fixtures is distributing an attractive booklet containing two interesting articles. One entitled "Off the Beaten Track" is written by Frank Roe, Jr., and describes how an unworked field was discovered and a market created by an indirect attack. "Street Lighting in Newark, N. J.," is the title of the other article which is reprinted from the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN and describes and illustrates the new system of street illumination recently installed in Newark in which ornamental poles designed by the Morris Company are used. In addition there is also contained in this publication several illustrations of ornamental poles of special design.

THE MITCHELL-RAND MANUFACTURING COMPANY, 88 Maiden Lane, New York, N. Y., has been organized to take over the business of W. E. G. Mitchell and to handle, as he has in the past, all sorts of material for insulation, including saturating and finishing waxes and waterproof compounds for insulated wire, hydrocarbon compounds, sealing cements, dry battery wax, asphalt, pot-head compounds, rubber substitutes, insulating and waterproofing paints, etc. The president of the new company is Lyman F. Rand, who has been engaged in this line of work for over twenty-five years, manufacturing these products for A. T. Howard & Company and for W. E. G. Mitchell, their successor, is a chemist and a graduate of Brown University. W. E. G. Mitchell is vice-president and treasurer. Mr. Mitchell succeeded A. T. Howard & Company about fourteen years ago in the insulating business, and is a graduate of the electrical and chemical courses at Pratt Institute. He is also interested in the Steers Supply Company and the Universal Compound Company. Charles L. Rand, secretary, is a graduate in chemistry at Cornell University, havng acted also as assstant instructor in chemistry at Cornell. He is largely engaged in research work on waxes and hydrocarbon compounds. The new company has extended its field to include fiber, mica, varnish and cloth.

DATES AHEAD.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

Minnesota Electrical Association annual convention, Minneapolis, Minn., March 29, 30 and 31.

Missouri Electric, Gas, Street Railway and Water Works Association, next convention at Jefferson City, Mo., on April 14, 15 and 16.

Florida Electric Light and Power Association, next meeting at Tampa, Fla., April 21, 1910.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) January 18, 1910.

947,224. TELEGRAPHIC TRANSMITTER. Patrick B. Delany, South Orange, N. J. Filed March 23, 1907. The dash signals are transmitted by uniform current of less strength than that used for the dot signals.

947,235. VENTILATED FUSE. Edward M. Hewlett, Schenectady, N. Y., assignor to General Electric Company. Filed August 26, 1909. An expulsion fuse comprises means for ventilating it under normal conditions, and means for confirming the blast of exploding gases in the region occupied by the fuse.

947,238. STORAGE BATTERY. Walter M. Jackson, Stamford, Conn., assignor of three-fourths to Walton Ferguson, New York, N. Y.; Joel M. Anderson, administrator of said Jackson, deceased. Filed July 8, 1908. One of the electrodes consists of metallic mercury, and the other of an alloy of lead, antimony and bismuth.

947,239. WEATHERPROOF HIGH-TENSION FUSE. Ernest H. Jacobs, Schenectady, N. Y., assignor to General Electric Company. Filed August 20, 1909. A line wire and a branch wire are connected through an expulsion fuse, the latter being inclosed in a housing of insulating material and in series with a disconnecting switch.

947,247. RESISTANCE UNIT. Edwin N. Lightfoot, Philadelphia, Pa., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed May 4, 1908. The resistance is carried by a fireproof insulating base on one of which are mounted two terminals, one terminal being connected to one end of the resistance and a conducting strip interposed between the base and the resistance for connecting the open terminal to the opposite end of the resistance.

947,251. ELECTRICAL SOUNDING-FORK VIBRATOR. Isidor Müller, Vienna, Austria-Hungary. Filed October 8, 1908. Comprises a tuning fork, electromagnet, etc.

947,266. RECORDING ELECTRICAL METER. Maurice J. Wohl, New York, and Harry Hertzberg, Brooklyn, N. Y., assignors to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Filed March 16, 1908. The indicator or recorder is operated by a pair of co-operating thermal expansible conductors connected thereto.

947,267. ELECTRICAL MEASURING INSTRUMENT. Maurice J. Wohl, New York, and Harry Hertzberg, Brooklyn, N. Y., assignors to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Filed March 31, 1908. Describes a form of meter for three-wire circuits—similar to the preceding.

947,274. SUSPENSION DEVICE FOR INSULATORS. Arthur O. Austin, Barberton, Ohio, assignor to the Akron Hi-Potential Porcelain Company, Barberton, Ohio. Filed May 13, 1909. The insulator unit is inclosed by and secured to a recessed body having a head integral with its closed end and provided with an inverted T-shaped recess, the latter interlocking with a suspension member.

947,279. ELECTRIC GENERATING-MACHINE. Ervin M. Fitz, Columbus, Ohio. Filed October 21, 1908. The armature comprises a shell-shaped device inclosing and revolving about a stationary inclosed field magnet.

947,313. MOTOR-CONTROL SYSTEM. Francis H. Shepard, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 15, 1905. A translating device, supplied with energy intermittently, is placed in series with a resistance connected to an intermediate in which is a battery-charging circuit which is automatically interrupted when the supply circuit is interrupted.

947,320. AUXILIARY SIGNALING APPARATUS FOR TELEPHONE-LINES. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed August 2, 1905. A device for permanently recording specific signals and having its circuit completed in parallel with the line signal, is adapted to be actuated when the circuit is closed between the limbs of the telephone line at a substation.

647,329. CONTROL SYSTEM FOR ELECTRIC MOTORS. Max Hartenheim, Hale, England, assignor to Westinghouse Electric and Manufacturing Company. Filed June 7, 1909. A generator and a motor have their armatures connected electrically in series and their field-magnet windings also in series. One of two auxiliary generators is included in the aforesaid field-magnet circuit and is provided with a balancing conductor connected through the other to a point in the field-magnet circuit which is located between the two windings.

947,335. CONNECTION-REGISTERING DEVICE FOR TELEPHONES. David S. Hulfish, Chicago, Ill., assignor to McMeen & Miller, Chicago, Ill. Filed May 23, 1906. A counting train has a pawl (pivotally attached to a motor arm) and a ratchet. There are escapement teeth on the armature of an electromagnet whereby the movement of the motor arm is controlled.

947,336. ELECTRIC-CIRCUIT CONTROLLER. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed April 10, 1908. Yieldingly supported arc-breaking contact members co-operate with a set of auxilary contact members.

947,338. RAILWAY-MOTOR. Samuel M. Kintner, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed May 4, 1908. The stationary field-magnet frame has a longitudinal passageway and a partition near one end thereof, and a commutator adjacent to the other end of the passageway.

947,340. TELEPHONE SWITCH APPARATUS. Stanislaw A. Koltonski, Boston, Mass., assignor to Electro Mechanical Works, Boston, Mass. Filed August 12, 1908. The trunk line or central-exchange circuit is held closed by an automatic retaining means in a manner independent of the operation of the switching devices controlling the branch circuits.

947,344. SPEED-REGULATOR FOR WINDING-ROLLS. Samuel L. Nicholson, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed March 23, 1908. The field excitation of the electric motor for driving a winding roll is automatically carried by a device the action of which is dependent upon the amount of material on the roll.

947,358. ELECTRODE. John W. Stubbs, Middlewich, England, assignor to the General Electrolytic Parent Company, limited, Middlewich, England. Filed October 23, 1909. The electrode has two separated straight metal conductor bars, crossbars of carbon placed at intervals between the conductor bars, and cast metallic connections between the conductor bars and the carbon bars.

947,389. DYNAMO-ELECTRIC MACHINE. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed June 2, 1905. The armature core is provided with slots the outer portions of which are wider than the inner portions; low-resistance conductors are located side by side in the outer wide portions of the core slots, and thinner flat high-resistance conductors arranged side by side across the inner narrow portions of the core slots with their larger faces parallel to radii passing through the slots in which they are located.

947,395. TRANSMITTER. William E. McCormick, Chicago, Ill., assignor to International Telephone Manufacturng Company, Chicago, Ill. Filed June 19, 1905. A telephone transmitter comprises a frame having a bridge, a diaphragm, a carbon cup having an electrode, and a combined damping device and electrode between the diaphragm and cup and reacting against the bridge.

947,404. LATCH FOR CUT-OUT BOXES. Thomas Q. Andrazyk, Chicago, Ill. Filed June 16, 1909. A simple spring latch is adapted to be operated by the thumb.

947,436. TROLLEY-WHEEL. George H. Downs, North Powder, Ore., assignor of one-half to William E. Grace, Portland, Ore. Filed March 24, 1908. The rims of the wheel have spike-like flange projections adapted to straddle a cross wire in passing.

947,437. STARTING AND STOPPING DEVICE FOR GAS AND OTHER ENGINES. Thomas W. Ellis, Denison, Tex. Filed Nov. 17, 1908. In combination with an explosion engine are: an electric motor having a driving connection with the engine, a pump driven by the engine, a tank for receiving water from the pump, and means where the attainment of a predetermined depth by the water in the tank will start the motor.

947,475. RECORDING TIME-LOCK. John F. Pixley, Columbus, Ohio, and Le Grand C. Bush, Chicago, Ill.; said Bush assignor to Clarence H. Pumphrey, Chicago, Ill. Filed September 18, 1906. The recording mechanism is set by an electro-responsive device.

947,490. MEANS FOR REGULATING THE ILLUMINATION OF FILMS IN KINEMATOGRAPHS. Bronislaw Gwozdz, Schmargendorf, near Berlin, Germany. Filed July 24, 1909. An electrical device comprises an electric circuit containing an apparatus which reacts to light transmitted through the film, for increasing or decreasing the strength of the light falling on the film.

947,515. FIELD SYSTEM FOR MOTOR ELECTRIC METERS. Carl W. J. Busch, Pinneberg, Germany, assignor of one-half to Hugo Roosen, Munich, Germany. Filed March 18, 1905. A field system for direct-current meters comprises an electromagnet having an air-gap, a stationary coil to energize the magnet, a magnetic shunt having an energizing winding thereon and capable of absorbing the remanent magnetism to render the field within the air-gap proportional to the current in the stationary coil.

947,516. INSULATOR. Walter T. Goddard, Victor, N. Y., assignor to the Locke Insulator Manufacturing Company, Victor, N. Y., Filed June 12, 1908. The insulator comprises a series of horizontally arranged flaring sections having closed outer ends secured to a horizontal support. A ring-shaped insulating member surrounds the flared sections and has means for securing an electrical conductor to the periphery thereof.

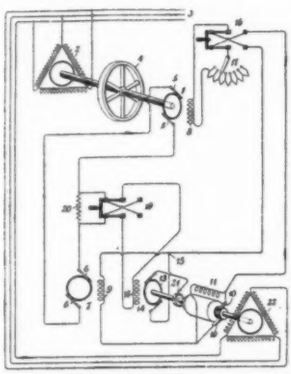
947,550. LAMP-HANGER. Walter M. Ramsey, Kalamazoo, Mich. Filed May 7, 1909. Describes a form of ceiling support for electric lamps.

947,575. STORAGE BATTERY. Julius E. Haschke, Chicago, Ill. Filed November 7, 1908. Comprises a containing casing, a cell structure therein, a grooved bottom and a packing interposed between the bottom of the cell and the casing soft enough to enter the grooved bottom of the cell, thereby tending to retain the cell against horizontal displacement in the casing.

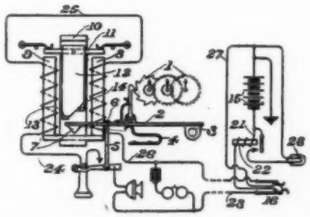
947,601. CONNECTION FOR WIRES OR CONDUCTORS. Edward Schmidmer, Nuremberg, Germany, assignor of one-half to Bernhard Wilmseu, Philadelphia, Pa. Filed March 23, 1909. Describes a form of Macintyre joint with nipples at the ends of the double tube.

947,612. HIGHWAY-CROSSING DEVICE FOR ELECTRIC RAILWAYS. Dudley T. Fisher, Columbus, Ohio, assignor to the Jeffrey Manufacturing Company. Filed January 2, 1909. A trolley wire having two sections with a gap between, has a connecting member to bridge the gap, and means for supporting this member and for lifting it in a horizontal position to give clearance, when not in operative position.

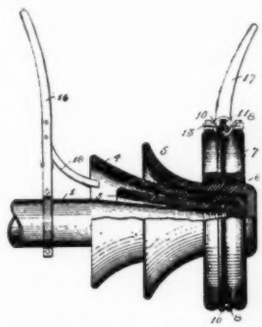
947,647. INDUCTION-GENERATOR FOR IGNITION PURPOSES. Henry J. Podlesak, Chicago, Ill., and Tesla E. Podlesak, Morristown, N. J. Original application filed September 25, 1901. Divided and this application filed January 28, 1908. Renewed February 10, 1909. In magnetic contact with the poles of a permanent magnet are pole-pieces each having three polar projections. An unwound inductor moves relatively to these



947,329—CONTROL SYSTEM FOR ELECTRIC MOTORS.



947,335—CONNECTION-REGISTERING DEVICE FOR TELEPHONES.



947,516—INSULATOR.

projections, the two outer projections of each pole-piece being unwound and the middle one being in inductive relation to coils of insulated wire.

947,677. FUSIBLE SWITCH. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Filed May 1, 1908. The switch has a fuse-plug receptacle and a switch blade comprising independent end portions (lying in substantially the same plane) one of which is forked and the other tongued at the inner end, and means for fastening the tongue and forked ends to the opposite contacts of the plug receptacle.

947,686. GOVERNOR OR REGULATOR. Frederick J. Pearson, Chicago, Ill., assignor to the Fisher Governor Company, Marshalltown, Iowa. Filed September 19, 1906. A prime mover is provided with electrically actuated means for cutting off and permitting the flow of energy thereto. The electrical actuating apparatus is operated by two devices each of which comprises a solenoid, and a pivoted lever arranged to be struck alternately by the cores of the solenoids. This lever opens and closes the circuit for the electrical actuating apparatus, and there are means for alternately opening and closing the circuits for the solenoids.

947,687. MAGNETIC CLUTCH. Henry W. Ravenshaw, Hanwell, England. Filed August 26, 1909. Describes a form of annular trough-shaped magnetic clutch supported by a suitable spider.

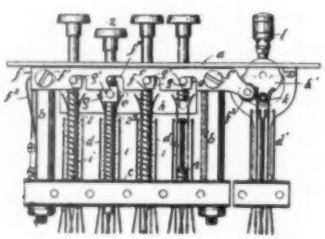
947,692. LIGHTNING-ARRESTER. William A. Binion, Lisbon, N. Y. Filed February 26, 1909. The lightning arrester comprises relatively movable electrodes providing an air gap, and electromagnetically actuated means responsive to an electric discharge through the arrester for submerging the electrodes in a body of insulating liquid to break the arc between the electrodes.

947,694. STATION-INDICATOR. Charles C. Cochran, Lawrence, Kan., assignor of one-half to Charles E. Dovey, High River, Canada. Filed October 25, 1907. Is electromagnetically operated.

947,722. SELECTIVE RINGING-KEY. Burton W. Sweet, Cleveland, Ohio, assignor, by mesne assignments, to Century Telephone Construction Company, Buffalo, N. Y. Filed September 28, 1906. In combination with plungers and associated sets of contact-springs adapted to be individually actuated thereby are transversely extending detents respectively provided on the plungers, a universal slide-bar equipped with angularly disposed recesses and under-cut points associated with the detents, a light spring opposing the longitudinal movement of the bar, and a slotted member accommodating the detents to prevent rotation of the plunger and insure the actuation of the slide-bar.

947,733. ELEVATOR SIGNAL SYSTEM. Henry J. Heeney, Boston, Mass., assignor to Holtzer-Cabot Electric Company. Filed October 26, 1907. Describes an electric signal system for a gang of elevators.

947,736. TIMER. Conley S. Martin, Danville, Ill. Filed February 8, 1909. Comprises a contact disk, a ball and socket bearing



947,722—SELECTIVE RINGING-KEY.

therefor, contact terminals, and means for rocking the contact disk into successive contact with the contact terminals.

947,741. APPARATUS FOR THE ELECTROLYTICAL DECOMPOSITION OF ALKALI-CHLORIDE SOLUTIONS. Johan J. Rink, Copenhagen, Denmark. Original application filed May 4, 1906. Divided and this application filed January 7, 1909. An alkali electrolyzer comprises a vessel containing the chloride solution, a perforated cathode presenting a single mercury-film adapted to receive a deposit at both sides, diaphragms at both sides of the cathode, anodes located outside of the diaphragms, and means for retaining concentrated solution inside and outside of the diaphragms.

947,744. ELECTRIC PAPER-CUTTER. Philip L. Stohr, Elgin, Ill. Filed October 3, 1908. A machine for cutting strips into predetermined lengths comprises a support, an energized circuit including cutting mechanism, means for feeding a strip to the cutting mechanism, means carried by the feeding device for pressing the strip against the support at the cutting mechanism, and contacts arranged adjacent the strip-feeding means and adapted to close the circuit through spaced conductors on the strip thereby to actuate the cutting mechanism.

947,754. ELECTRICAL CONNECTOR. Sidney B. Perkins, Cleveland, Ohio, assignor of one-half to Carl Weber, Cleveland, Ohio. Filed September 2, 1908. Renewed June 29, 1909. The wire is secured in a grooved two-section externally threaded bolt by a collar screwed on the bolt.

947,758 and 947,759. TROLLEY-WHEEL. Clesson W. Putnam, Holyoke, Mass., assignor to B. F. Perkins and Son, Incorporated, Holyoke, Mass. Filed July 24, 1909. Describe forms of built-up trolley wheels.

947,763. MULTIPLE SOCKET FOR INCANDESCENT LAMPS. Frank J. Russell, New York, N. Y. Filed April 13, 1908. A multiple lamp cluster has a two-part body, one part carrying lamp holders and the other a contact ring, and each lamp holder having a contact finger to make connection with the contact ring when the parts are united, and means separate from the contacts detachably to secure the two parts of the body together.

947,768. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES. Frederick W. Young, East Orange, N. J. Filed July 19, 1909. In combination with a commutator bar is a zigzag folded metallic strip in contact with the bar which forms a continuation of the contact surface of the bar and in which the several folds are separated by insulation.

REISSUE.

13,079. INSULATED JOINT FOR RAILWAY-RAILS. Koby Kohn, Lincoln, Neb., assignor to the Rail Joint Company. Filed July 23, 1909. Original No. 879,878, dated February 25, 1908. Comprises a channeled base support having a brace portion, a thrust portion, and an interposed web portion forming a vertical channel, and insulating means.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 31, 1910:

490,663. ELECTRIC BLOCK SIGNAL SYSTEM. John La Burt, New York, N. Y.

490,678. APPARATUS FOR ELECTRICALLY TREATING THE EYES. Wm. A. Price, Iowa Falls, Ia.

490,679. APPARATUS FOR ELECTRICALLY TREATING THE EAR. Wm. A. Price, Iowa Falls, Ia.

490,684. AUTOMATIC ALARM DEVICE. Geo. W. Schilling and John G. Haslam, Philadelphia, Pa.

490,698. ELECTRICAL TIME-INDICATING APPARATUS. Edward Weston, Newark, N. J.

490,700. ELECTRICAL MEASURING INSTRUMENT. Edward Weston, Newark, N. J.

490,725. ELECTRICAL PRESSURE INDICATOR FOR STEAM GAUGES. Edward G. Smith, San Jose, Cal.

490,746. ELECTRIC SWITCH. Jacob S. Gibbs, Hartford, Conn.

490,753. SECONDARY BATTERY ELECTRODE. Harry G. Osburn, Chicago, Ill.

490,755. CONNECTOR FOR ELECTRICAL CONDUCTORS. Geo. L. Russell, Middletown, Conn.

490,760. ELECTRICAL MEASURING INSTRUMENT. Edward Weston, Newark, N. J.

490,761. ELECTRICAL SIGNALING SYSTEM. Adoniram J. Wilson, Port Chester, N. Y., and Wilmer W. Salmon, Chicago, Ill.

490,762. ELECTRIC CIRCUIT BREAKER. Edward M. Bentley, Boston, Mass.

490,809. DYNAMO-ELECTRIC MACHINE. Robert Lundell, Brooklyn, N. Y.

490,810. DYNAMO-ELECTRIC MACHINE OR ELECTRIC MOTOR. Robt. Lundell, Brooklyn, N. Y.

490,839. THERMAL CIRCUIT CLOSER. Elihu Thomson, Swampscott, Mass.

490,870. ELECTRIC BURGLAR ALARM. Warren H. Carr, Bath, Maine.

490,891. ELECTRIC WARMING BOTTLE. Thomas Ahearn, Ottawa, Canada.

490,903. COMBINED GAS AND ELECTRIC LIGHT FIXTURE. Francis X. Gartland, Philadelphia, Pa.

490,984. ELECTRIC BELT. John W. Cummings, old Hill, Nev.

490,984. ART OF GENERATING ELECTRICITY. Thomas A. Edison, Menlo Park, N. J.

490,954. MANUFACTURE OF CARBON FILAMENTS FOR ELECTRIC LAMPS. Thomas A. Edison, Llewellyn Park, N. J.

490,959. COUPLING OR DYNAMO-ELECTRIC MACHINES IN PARALLEL. Albert Gay, London, England.

490,975. ELECTRIC RAILWAY. Edward W. Mitchell, Covington, Kentucky.

490,992. ELECTRIC ARC LAMP. Jas. Sugden and Wallace J. L. Sandy, London, England.

491,004. ELECTRIC STOP MOTION FOR KNITTING MACHINES. Winslow M. Bell, Milton, N. Y.